INDIANAPOLIS SEP 1 1900 PUBLIC LIBRARY

AMERICAN MACHINIST

A PRACTICAL JOURNAL OF MACHINE CONSTRUCTION

VOLUME 23 — NEW YORK AND LONDON — NUMBER 35

Published at 218 William St., New York,
Every Thursday by the

American Machinist Press.

[INCORPORATED.]

JOHN A. HILL, President and Treasurer.
A. LEIGHTON DONNELL, Sec'y.

Also published at 34 Norfolk St., Strand, London, W. C.,
Every Saturday.

FRED J. MILLER, Editor.

FRANK RICHARDS,
F. A. HAISEY,
EDWARD P. BUFFET,
} Associate Editors.

Representatives of Business Department

ANGUS BALLARD, for New England.
JOHN MCGHIE, for Middle States.
WILLIAM R. WALLIS, for the West.

Correspondence on mechanical subjects solicited. Name and address must always be given—not necessarily for publication.

Address all business communications to the American Machinist Press. Matter for reading columns may be addressed to the Editor.

Subscribers can have address changed at will. Give old and new addresses. Date on wrapper denotes end of month in which subscription expires.

Subscription Price:

$3 per year in advance, postage paid, in North America.
$4 per year in foreign countries, postage prepaid.
No back numbers beyond current year.
For sale by newsdealers, generally.

AMERICAN MACHINIST CO., Ltd.,
34 Norfolk St, Strand, London, W. C.

ADPHE. JANSSENS, Ingr.,
16 Place de la République, Paris.
10 A Boulevard Barthélemy, Bruxelles.

V. LOWENER,
Copenhagen,
Representative for Denmark, Norway and Sweden.

GUSTAV DIECHMANN & SOHN,
Neue Promenade 4, Berlin,
Representatives for Germany, Austria and Holland.

J. F. VILLALTA,
Puertaferrisa, 7-9 Barcelona,
Representative for Spain.

Entered at New York P. O. as second-class mail matter.

Cable address, "MACHINIST," N. Y.
Lieber's and A B C Codes.

"Marking Time" for Seventy Years.

It is quite the fashion in these days, especially in the American press, technical or secular, when discoursing upon mechanical and engineering topics, to indulge in continuous self-gratulation over what we have done and what we are doing. As the story goes, we are all the while astonishing ourselves and all the world at the rate of our progress and the individual developments which mark it. Much of this, no doubt, is warranted, but there is still room for question whether the advance has been what should have been expected all along the line. We are unable to repress the conviction that we are in some lines far behind where we should have been in the natural course of events, as that course was indicated more than half a century ago. The special field of development which we have at present in mind is that of the mechanical propulsion of vehicles, both freight and passenger, over our public roads. We take the liberty of going back something more than the half a century just alluded to, say seventy years, or, to be exact, to the year 1831, and calling attention to what was being done at that time. We need not call attention to the fact that those were the days of the infancy of the steam engine, and that the other means of power development and transmission which have since developed so magnificently were then unborn and undreamed of.

It is a rather curious circumstance that in commenting upon the status in 1831 of the self-propelling vehicle upon common roads we find the dignified "Edinburgh Review" indulging in the same strain of disappointment and reproach which we today feel impelled to give words to. It says, October, 1832:

"When it is considered that several years have now elapsed since the practicability of propelling a carriage on a common road was established by incontestable experiment, it will naturally be inquired, why in a nation celebrated over the world for its mechanical skill and commercial enterprise, and abounding in capital, the project has not yet attained a more advanced stage?" This, written sixty-eight years ago, could be written and fully justified to-day. That there was full warrant for it even then is evident from the simple statement of facts which is given:

"It appears that after several years of indefatigable exertion, during which he [Goldsworthy Gurney] had to encounter and refute innumerable objections urged against the scheme—such as the expense, the public annoyance, the removal of horses from employment, the putting of coachmen, etc., out of bread, and all the hackneyed topics by which great improvements in machinery have been ever opposed—Mr. Gurney at length succeeded in getting a steam carriage established as a public conveyance between Gloucester and Cheltenham in February, 1831. It commenced running on the 21st of that month, and continued until the 22d of June—a period of four months—during which it performed the journey of nine miles between these places regularly four times a day. It carried in this time upward of 3,000 passengers, without a single accident, at a greater speed than that of horse coaches, and at half their fares. The value of the coke expended in this performance was about £50—giving an annual rate of about £150 for fuel. A horse coach to perform the same work, going at the rate of from eight to ten miles an hour, would have required eighteen horses constantly to be maintained."

A long story is told of the persistent opposition which the new mode of transportation encountered. The roads were obstructed by stones, which made them impassable for the horse coaches when loaded, and Mr. Gurney strengthened his wheels so that he overcame this obstacle; but he could not ride over all the acts of Parliament hastily passed. "In some cases the tolls imposed amounted to 40s. ($10) at every gate; in others to 48s., and in some to 68s.; and, as if it were a national object to prevent the possibility of such engines being used, one of these acts applied to the road between Cheltenham and Gloucester."

Mr. Gurney petitioned against this injustice, and a committee of the House of Commons was appointed. The report of this committee is of great interest in view of the date of its appearance, if for no other reason. Mr. Gurney in his narrative says: "The committee, like all parties unacquainted with the real merits of the question, at first, I believe, considered the subject more visionary than real. How differently their minds were affected in the progress of inquiry may be judged of when it is stated that they soon applied for further powers, and deemed the matter worthy of close and deliberate investigation for three months. During that time some of the first statistical, scientific and engineering authorities gave voluntary evidence on the subject."

The "Edinburgh Review" continues:

"In the progress of their inquiry the committee extended their examination to the principal objections which had been urged to the application of steam on common roads. These were, the danger of explosion, the annoyance to travelers, the fright occasioned to horses by the noise of machinery, and the smoke and steam which escape at the chimney. The committee state that they are led to believe, by the result of their inquiries, that the substitution of inanimate for animal power on common roads is one of the most important improvements in internal communication ever introduced; that its practicability has been fully established; that tolls to an amount which would utterly prohibit the introduction of steam carriages have been imposed on some

roads; that on others the trustees have adopted measures which place such carriages in an unfair position compared with ordinary coaches."

"Their report goes on to say:

" 'Without increase of cost we shall obtain a power which will insure a rapidity of internal communication far beyond the utmost speed of horses in draught.

" 'Nor are the advantages of steam power confined to the greater velocity attained, or to its greater cheapness than horse draught. In the latter, danger is increased, in as large a proportion as expense, by greater speed. In steam power, on the contrary, there is no danger of being run away with, and that of being overturned is greatly diminished. It is difficult to control four such horses as can draw a heavy carriage ten miles per hour, in case they are frightened, or choose to run away; and for quick traveling they must be kept in that state of courage that they are always inclined for running away, particularly down hills and at sharp turns of the road. In steam, however, there is little corresponding danger, being perfectly controllable, and capable of exerting its power in reverse in going down hills.' "

The report of the committee of Parliament thus summarizes the status of the steam road vehicle in 1831:

"1. That carriages can be propelled by steam on common roads at an average rate of ten miles per hour.

"2. That at this rate they have conveyed upward of fourteen passengers.

"3. That their weight, including fuel, water and attendants may be under three tons.

"4. That they can ascend and descend considerable inclinations with facility and safety.

"5. That they are perfectly safe for passengers.

"6. That they are not (or need not be) if properly constructed, nuisances to the public.

"7. That they will become a speedier and cheaper mode of conveyance than carriages drawn by horses.

"8. That, as they admit of greater breadth of tire than other carriages, and as the roads are not acted on so injuriously as by the feet of horses in common draught, such carriages will cause less wear of roads than coaches drawn by horses."

We are not unaware of what is going on just now toward the development of the road vehicle, but as things have stood up to a time very close to the present, what have we been doing but "marking time" instead of making progress? It must surely be a marvelously perfect and satisfactory machine that we have to show in universal use before we can boast much of our seventy years of progress in this direction.

White and Hichborn.

The relief of Sir William White as head of the construction department of the British Navy and the appointment of Mr. Watts to that position, with the salary of $15,000 a year and allowances, calls attention to the compensation which this Government gives its corresponding officer. Rear-Admiral Hichborn and Sir William White had a good deal in common. Each started life as a shipwright's apprentice—White in the Devonport dock yards, Hichborn in the Boston Navy Yard. Each worked his way up step by step. They are about the same age, closely resemble each other in personal appearance and manner of speech, both being direct, forceful, plain-spoken men. While the British official receives about $20,000, the chief constructor of our navy is paid but $6,000. Rear-Admiral Hichborn has devolving upon him the same responsibilities and tasks which are attached to the work of the British chief constructor. At present he is directly responsible to the Government for the design and construction of seventy ships of war, embracing all types, from battleships to torpedo boats. Rear-Admiral Hichborn and Sir William White have maintained a close personal friendship for many years.—"Marine Review."

It is probable that professional men who are called upon to assume great responsibilities in America are on the average not so well paid as they are in England, and, generally speaking, we are inclined to think that this is partly due to the vicious habit followed here of accepting such positions at a salary known to be too low "for the sake of the experience," and for various other nonsensical reasons that should have no weight whatever. When a position of responsibility is to be filled by an engineer, he should insist upon being considered worthy of his hire, and whatever experience he may gain in addition is rightfully his. Six thousand dollars per year salary for the chief constructor of our navy is absurdly inadequate when the responsibilities of the position are considered, although in this case it is to be remembered that the position carries with it certain other advantages, not the least of which is the assurance of a permanent position during active life and a salary for life after retirement, and these circumstances relieve the officer of some of the most bothersome problems that trouble the salaried man who works in a private capacity.

Kimberley's Engineer Hero.

In our issue No. 30 we mentioned a paper read before the Institution of Mechanical Engineers, at their recent London meeting, describing the building of a long-range gun at Kimberley, South Africa, while that place was besieged by the Boers. Since then we have had requests to print the paper in full, which we accordingly do in this issue.

The paper is an unusually interesting one from beginning to end, and the interest of it could not fail to be enhanced to us by the fact that the lamented engineer who directed the construction of the gun was an American. The general manager, also, Mr. Gardner F. Williams, of the De Beers Consolidated Mines, was an American, and from a letter written by him to Mr. Frederick Labram, of Milwaukee, father of the distinguished engineer, we get this account of his death:

"For several days past the Boers have been shelling Kimberley with 100-pound shells, in addition to the ordinary 9-pounders. Mr. Labram went to his room at the Grand Hotel about 6 o'clock this evening, and had not been in there more than five minutes when a 100-pound shell burst through the roof and walls and came crashing into his room with full force, and exploded as it entered. It becomes my painful duty to inform you that Mr. Labram was killed instantly."

He was buried at Kimberley with full military honors at 8 o'clock in the evening, to avoid as much as possible the shelling, which was kept up all day. Mrs. Labram left Kimberley before the war began, and received the intelligence of Mr. Labram's death at Aurora, Ill.

Hazards of Doing Business in Russia.

Now that American manufacturers are turning their attention more and more to the Russian market, it is important that they should realize the risks entailed in carrying on business with that country. In a general way it is well known that credits there are long, sometimes amounting to a year, but it is questionable whether the obstacles that may be encountered if one attempts legal enforcement of a claim in Russia have been sufficiently dwelt upon. The Germans who have close business relations with Russia, and understand trading there perhaps better than any other foreigners are themselves embarrassed by these disadvantages. The Chamber of Commerce of Frankfort has published a statement about Russian credits and commercial laws, a summary of which has been forwarded to the American State Department by Consul-General Richard Guenther. It is as follows:

"Since the operation of the German-Russian commercial treaty cases have increased in which German firms could not collect payment for their goods without recourse to law, and the losses sustained by firms who did not exercise caution in extending credit have been very heavy.

"In the large cities of Russia—Moscow and others—there exist many absolutely reliable firms. The average commercial trustworthiness, however, is of a lower order than in Western Europe. Nowhere is it more essentially necessary to obtain information concerning the standing, responsibility, and honesty of buyers than in

Russia, and nowhere is it so difficult to obtain. Commercial bureaus of information are not permitted by the Russian Government. Those people who, in spite of this prohibition, conduct this sort of business have to do so under cover, which creates suspicion and makes public control impossible. The respective consuls cannot be of service, as their official position prevents them imparting unfavorable information relative to Russian firms in their districts. The best way would be always to apply to responsible foreign bureaus of information. With reference to merchants in the provincial towns, with the exception perhaps of some foreigners doing business there, it is quite impossible to obtain any information. Even Russian firms send agents to these places in order to gain the desired data on the ground. All merchants in Russia work with a large loss account. German firms frequently ship goods before they have received the information requested, and if an unfavorable answer arrives after the shipment they try to stop delivery of the goods already on Russian soil. This cannot be done. According to Russian law, all merchandise which has crossed the border and arrived in Russian territory is the property of the Russian addressee, and the forwarding agent has to deliver it to him, even if the sender should send orders to the contrary. A judicial seizure cannot be made in most cases, as payment has not yet become due.

"Great caution must be exercised in the choice of an attorney at law; there are two classes in Russia—sworn and private attorneys. Only the former are organized as an association, and its members are much more reliable and trustworthy than the latter. It is always advisable to employ only 'sworn' attorneys. In the interior, aside from other causes, it is impossible to successfully sue a merchant, as no reliable attorneys exist there. Many attorneys are in the habit of considering sums recovered for their clients through the court as their own property and using them for private purposes.

"The mode of compensation for attorney's service in Russia is very different from that in Germany. The Russian law prescribes that attorneys have to make an agreement with their clients before taking a case. Often, reimbursement for costs and a percentage of the sum recovered is agreed upon, varying between 5 and 20 per cent. In Russia all debts exceeding 150 rubles ($77) and all protested commercial papers have to be sued in the commercial courts. The losing party is assessed only a very small portion of the costs of the suit. The foreign claimant has therefore to stand almost the entire costs, even if successful, and even when the defendant by all manner of trickery has purposely increased the costs.

"It must also be borne in mind that on demands denied by the court a fine of 5 kopecks (2½ cents) per ruble is to be paid, and for unwarranted appeals 10 kopecks per ruble in favor of the judges. The whole court institution is maintained by these fines. They are collected in the most rigorous manner, even in cases of arbitration, where the plaintiff from the start is willing to abide by the decision of the arbitrators. Although everybody in Russia agrees that the manner of doing business in these commercial courts, which dates back from about 1820, is superannuated, it has so far not been possible to institute reforms.

"The Russian law recognizes no maturity of a claim. Merchants can therefore recover interest after maturity of claims only when this has been explicitly stipulated by a contract; otherwise, a claim for interest at 6 per cent. must be stated specially in the judicial decree. But interest never commences before the day of bringing suit. A merchant in Russia can be declared insolvent if claims against him exceeding 1,500 rubles ($772) are due. In practice, only notes due are considered.

"For the foreign exporter the possibility of a contest hardly ever exists. It happens very often that the debtor whom bankruptcy stares in the face transfers his business and the whole stock to his wife or other persons, and nothing can be collected. The creditors may have him declared a fraudulent bankrupt, but cannot recover, as the purchasers of the business of the debtor cannot be reached. The attachment of goods *in natura* cannot be made, not even where held on commission, as according to the letter of the law all goods, with hardly an exception, must go into assets."

The Bethlehem Steel Company has just completed the largest built-up gun ever made in this country—the 18-inch Gattamann torpedo gun. It is to throw in test ten solid shots, each weighing 2,000 pounds, and in service will throw shells charged with gun cotton that, it is stated, will travel farther than any shots ever hurled from any gun before.

Commercial Review.

NEW YORK, Saturday, Aug. 25.

It is not easy to imagine how things in the machinery trade could be more healthily quiet or more quietly healthy than at the present time, so that for this, which is practically the last week of the vacation season, it is not worth while, nor could it be to anyone's benefit to attempt to make a perfunctory report, when there is so little demanding remark. This is a time when all are more or less waiting, but waiting without apprehension. The expected disturbing causes and excitements which have been anticipated for this season have proved so far quite tame. The political situation is, both at present and prospectively, not such as to seriously disturb anyone, and our foreign relations are also easier than a short time ago could have been expected. The internal affairs of the nation and and the crop conditions are satisfactory. The weekly trade reports in the daily press tell of growing confidence in business. Reports regarding the iron trade are in the main encouraging. The demand for raw material and for many manufactured products is increasing to an extent that has caused a hardening of prices in a number of cases. A striking evidence of the general business activity (which means prosperity) is in the increase of bank clearings. For the first six months of 1894 the total of the bank clearings of the country was $22,000,000,000. For the first six months of 1900 it was $42,000,000,000, or nearly double. The iron shipbuilding trade seems to be the spot where our greatest encouragement is to be found. The Cramps have 8,000 men in their employ, the largest number ever on their books, and they are still enlarging. The same activity prevails in other yards upon both seacoasts and upon the lakes.

The Bethlehem Steel Company, which shows a commendable determination to let the world know continually what it is doing, reports recent orders for spare propeller shafts for the steamers "Ponce" and "San Juan," of the New York & Porto Rico Line, which are being furnished to Harlan & Hollingsworth Company, of Wilmington, Del. It is also supplying eight forged hollow shafts of fluid compressed open-hearth steel for use in Cuban sugar mills, and, in addition to these, is making a large number of gun barrels for the Winchester Repeating Arms Company and Colt's Patent Fire Arms Company. These latter forgings are to be made of Bethlehem nickel-steel.

According to a press dispatch of August 24, Minister King, at Bangkok, informed the State Department that he has succeeded in securing an open tender for American manufacturers in the construction of the Petchaburee Railroad by the Siamese Government. Bids for the construction of a plant for the manufacture of ammunition in that country were opened to American competition in March, and a bid was asked from the United States on 20,000 rifles and 10,000,000 cartridges.

An encouraging report from Cleveland reaches us from the Cleveland Punch & Shear Works Company, which company writes us as follows:

"We have let contracts for extensive improvements to our plant by which our capacity will be greatly increased. This has become necessary by reason of increased business and the growing demand for heavier tools in our line. Among recent shipments of our machines are the following: Bending and straightening machine for the Wm. R. Trigg Company; 54-inch throat punch for the Hamler Boiler & Tank Company; 6-foot arm radial drill for the Charleston Boiler & Foundry Company; 8-foot arm radial drill for the Cam-

pagnie Internationale d'Electricite, Liege, Belgium; 36-inch throat punch for the Patterson Supply Company, of Cleveland; 12-foot arm radial drill for the Carnegie Steel Company; 10-inch throat horizontal punch for the Joliet Bridge & Iron Company; 18-inch beam coping punch for the Easton Foundry & Machine Company; 36-inch throat punch for the Belmont Iron Works; 'T' horizontal punch for the Phoenix Iron Works, and a 12-foot arm radial drill and 36-inch throat punch for the Hawley Down Draft Furnace Company. Inquiries for our tools are coming in satisfactorily, and we anticipate a busy fall season."

PITTSBURGH REPORT.

The amount of new business expected for this time of the year has failed to materialize, even though prices are as attractive as it is possible to make them. There seems to be a strong feeling of confidence that the month of September will see a change in favor of a stronger demand and better prices. Stocks of raw material are coming down rapidly, and the market for pig iron is registered nearly at zero, if the small lots of 25 and 50 tons were not taken into consideration.

The iron and steel market movements are practically confined to structural material, sheets, plates and bars, with sheets leading in the race. The "letting loose" of the structural selling arrangement has had no bad effect, and unless the demand falls off the producers will be as well off under the less rigid terms of individual discretion as when the association agreement was in force.

One of the best arranged and most modern equipped plants of its kind in the country is the new pipe and boiler tube mill of Spang, Chalfant & Co., at Etna, near Pittsburgh. The mill is entirely operated by electricity, and is said to be the only one in the world to be so driven. No two machines in the mill are run by the same motor. In all twenty-three motors are required to keep the mill in operation. The capacity of the plant will be 80 tons of tubing per day, consuming in all 100 tons of steel daily. The main building is 440x 100 feet, the warehouse 75x140 feet.

All details have been perfected for the organization of the Crucible Steel Company. From what can be learned the company does not intend to operate coking plants or to lease coal lands, preferring to do business with outside parties for their fuel supply. The company will take up the manufacture of projectiles on a larger scale, this line of business being formerly carried on by the Benj. Atha & Illingsworth Company; the foreign trade will be looked after by the London and Liverpool offices of the Park Steel Company, Ltd., but which will hereafter be known as the Crucible Steel Company.

CINCINNATI REPORT.

The fag end of August finds little material change in the lethargic condition that marks the demand in the machine tool way. Manufacturers of smaller tools and shapers find more in the present condition to feel optimistic over, and a consensus of opinion develops a remarkably unanimous feeling among larger manufacturers that large buyers are holding off mainly because of the pending readjustment of irons and the expected low price of castings. While admitting that prospects are fair for fall trade, few will admit that there will be any material demand until October. As in all lines of industry, there is found in that of machine tool making a situation not warranted by general conditions. The Bradford Machine Tool Company, for instance, is working nine-tenths full capacity, and until the death of President Stewart, a few months ago, finished a phenomenal record of four years, running seven days a week on full capacity. Fifty-seven hours constitute a week's work with this company. Houston, Stanwood & Gamble, engine builders, are also working on full time, and for some time past have been running over-time—ever since last October full twenty-four hours a day. This firm reports prospects very good. At the offices of the Cincinnati Milling Machine Company arrangements are under way for welcoming Secretary F. C. Geier, who has been in Europe the past three or four months. Mr. Geier is expected to land in New York on the 24th. This company has just filled an order for eight milling machines for England, and to-day received one of good size from the East. President March, of the Cincinnati Shaper Company, believes prospects are fair for early fall inquiry, but does not believe much business will be placed until after election. His firm has been running at a very fair capacity, filling old orders. The vacillating conditions in the iron market have little interest for the machine tool makers as a rule just now, because all those larger concerns that are running are still working on high-priced material purchased to supply the phenomenal trade of early spring. It is generally felt among the machine tool manufacturers that the buying public believes that because pig iron is down castings should be, and therefore prices of machines. An official of one of the larger concerns makes the point that castings are not so low as a year ago, and that molding is higher. Thus, material and labor being more costly, will naturally affect prices for some time to come. Another exception to the general order of things in the way of demand is noted in the case of the Bradford Machine Tool Company. This concern received more inquiry this month than last. As a rule, last month was better with the manufacturers generally. Makers of boilers and engines, as a rule, report conditions exceedingly promising.

CHICAGO MACHINERY MARKET.

There is little complaint at the character and volume of business in engines and boilers. A few builders say trade is comparatively quiet, and they include some of the larger makers, but this opinion is not shared by a majority of sellers in the West. The slackness to trade noted by the minority of builders is partially explained by the fact that they are sold far into the future and cannot promise deliveries which other builders, less burdened with orders, can grant. The demand for power comes largely from manufacturing plants, prominent among which are cement works, paper mills and beet sugar manufactories. Mining operations in the Rocky Mountain regions are calling for large quantities of machinery. The representative of a machinery builder just returned from the Black Hills says one gold mining company is spending this year $1,250,000 for improvements, including a crane to cost $200,000, erected for emergency purposes only. Dividends of the company are limited to 50 per cent. a year and the company has a large surplus to expend. This is an extreme case, doubtless, but in the mining regions there is now more than the usual activity in machinery improvements.

Prospective buyers of boilers are no longer waiting for expected reductions in prices. Plates have ceased to decline, and the prices of boilers are now firm on a lower basis. This has tended to help business, in addition to the necessity of buying immediately in order to secure installation before the approach of cold weather. The latest inquiries in the market partake largely of indefiniteness in the matter of delivery. They are many in number, but seem to be looking farther into the future than for some time past, possibly to bridge over the gap of winter, during which deliveries would be undesirable in much territory.

For its new shops at Bloomington, Ill., the Chicago & Alton road has purchased from the Buckeye Engine Company, of Salem, Ohio, three high-speed, direct-connected engines of 350 horse-power each and one engine of 100 horse-power. It has also bought boilers of similar capacity from the Sterling Company, of Barberton, Ohio.

Among recent sales of the Wickes Bros., Saginaw, Mich., were boilers of 750 horse-power to a paper mill at Mt. Carmel, Ill.; a 125 horse-power boiler to Williams, White & Co., Moline, Ill., and one of 150 horse-power to the Morden Frog and Crossing Company, of Chicago.

The Vilter Manufacturing Company, of Milwaukee, Wis., has sold among other recent orders a 1,200 horse-power cross-compound condensing Corliss engine for the Baltimore & Ohio transfer elevator at South Chicago; also a 300 horse-power special Corliss for the light manufacturing building of William F. Grower, Chicago.

The Heine Safety Boiler Company has just sold a 600 horse-power boiler to the University of Iowa, Iowa City, Iowa.

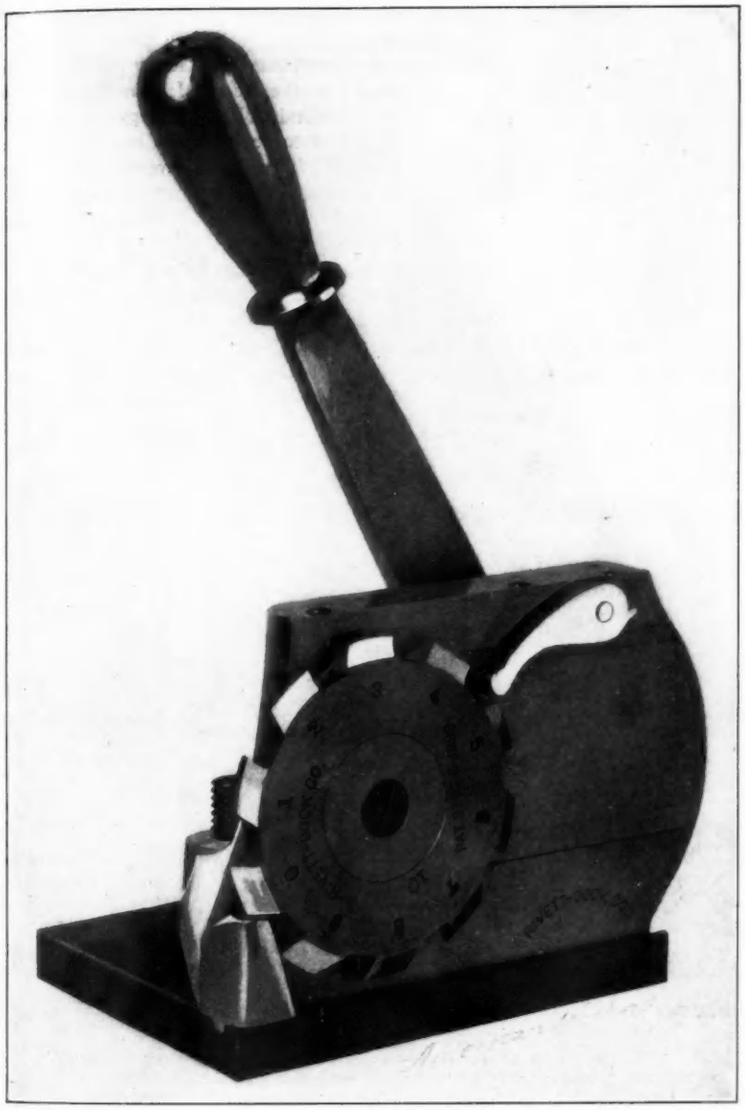


FIG. 54. THREAD CHASING TOOL SHOWN AT PARIS BY THE RIVETT-DOCK COMPANY.

The Paris Exposition—X.

A NEW THREADING TOOL.

A tool which attracts a great deal of attention relatively to its size is shown at Figs. 54, 55 and 56. This is a threading tool to be used in the lathe, and it greatly simplifies the operation of threading lathe work, while at the same time it enables such work to be done more rapidly than by any other tool I have ever seen for the purpose. Just why it will cut threads so much faster than the ordinary tool in the hands of a skilled man is not at first glance apparent, but it results from the fact that the character of the cuts taken by it is entirely different from that of those taken by the ordinary tool. Every cut taken over a thread by the ordinary threading tool is taken with the point of the tool cutting to the full depth of the cut, and the point is as fine as is required for the last cut, which is the only one that really determines the shape and finish of the thread. In other words, where we start in to chase a thread in the usual manner we use our threading tool for roughing cuts—merely for removing stock—until we come to the last cut, when the same tool is used for finishing. With this new tool the roughing cuts are taken by cutting edges specially designed for doing that work, while the finishing cut is taken by an edge which does nothing else but take finishing cuts; and, as would naturally be expected, the results are very superior.

With this tool the cutter resembles a milling cutter; it has ten teeth, but no two of them are precisely alike. This cutter is mounted upon a slide fitted to a special rest, as shown in Fig. 54, which special rest is designed to go on to the tool rest in place of the usual post. The slide is movable to and from the work by the lever, and this lever is used instead of the cross-feed screw for withdrawing the tool at the end of a cut and for replacing it in position at the beginning of the next cut. But as the tool is withdrawn it is rotated one tooth by the pawl seen in Fig. 54, so that when it goes back to cutting position a new cutting edge takes the suc-

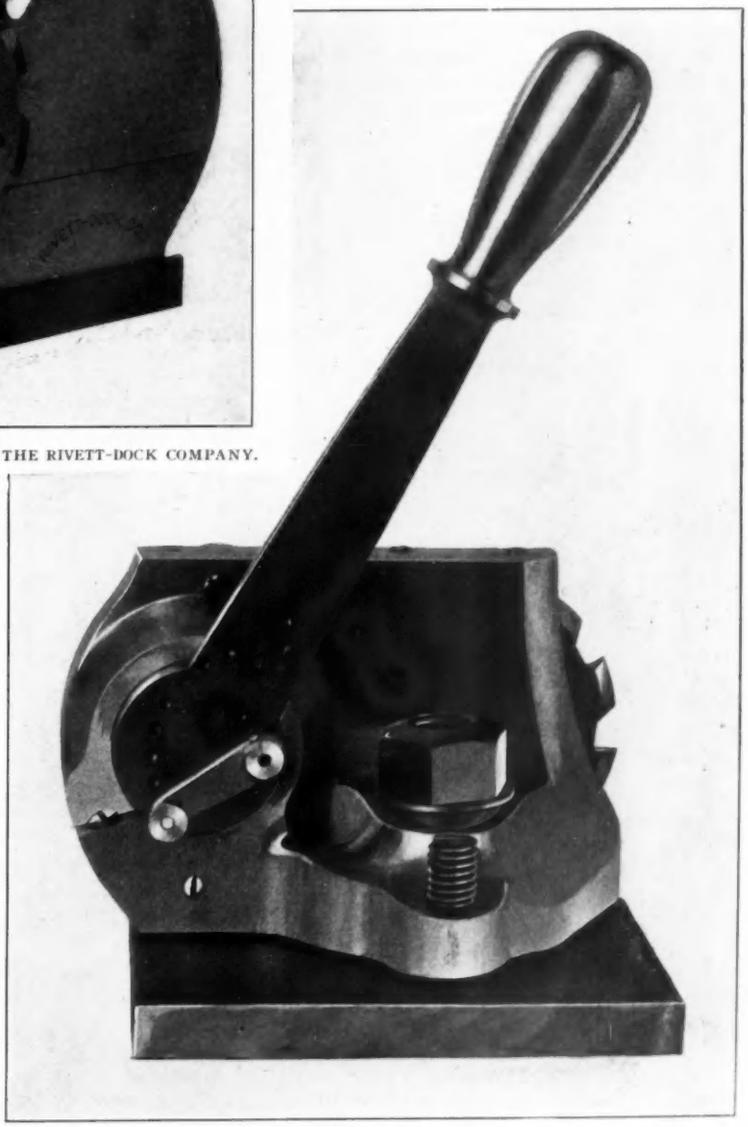


FIG. 55. THREAD CHASING TOOL SHOWN AT PARIS BY THE RIVETT-DOCK COMPANY.

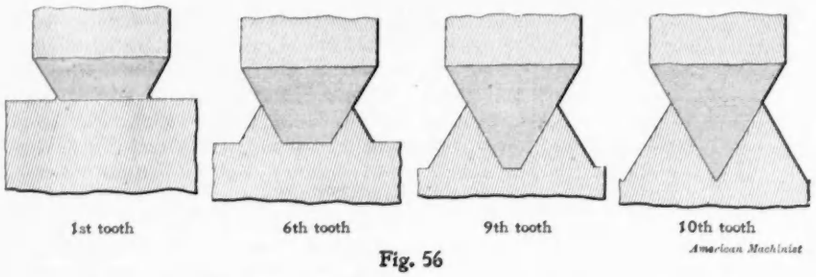


Fig. 56

SHOWING CHARACTER OF CUTS TAKEN BY NEW THREADING TOOL.

ceeding cut; and so on to the finish. As the tool goes forward the cutting edge which is to take the cut is made to rest upon a screw-head, as shown in the engraving, which supports it solidly; and finally, when the finishing edge has taken a cut it can be advanced a very little to take as many scraping cuts as may be desirable by moving the small lever with index pin seen in Fig. 55.

The first cutting edge takes a cut the full width of the thread at the top, as shown at Fig. 56, and each succeeding edge simply deepens this groove, Fig. 56 representing the cuts taken by the first, sixth, ninth and last or finishing tooth for a V-thread. Since the depth of each succeeding cut is regulated by the tool itself, and the operator has only to work the lever at the end and at the beginning of the cuts and to reverse his lathe or open the nut to run back at the right time, the operation of threading is manifestly much simplified, and it is certain that a superior quality of threads can be cut by the tool at a considerably more rapid rate than is possible with a tool of ordinary form. It is being exhibited by Payson Bullard at Vincennes for its makers, the Rivett-Dock Company, Brighton, Boston, Mass.

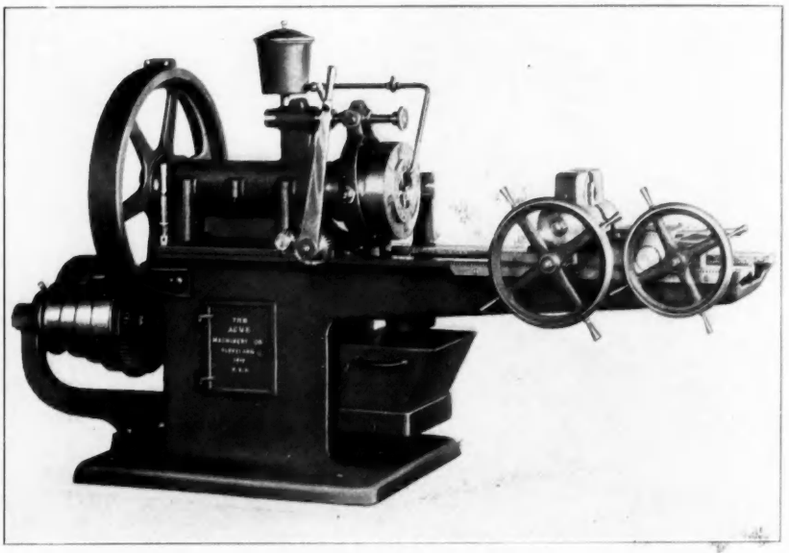


FIG. 57. IMPROVED THREADING MACHINE SHOWN AT PARIS BY THE ACME MACHINERY COMPANY, OF CLEVELAND.

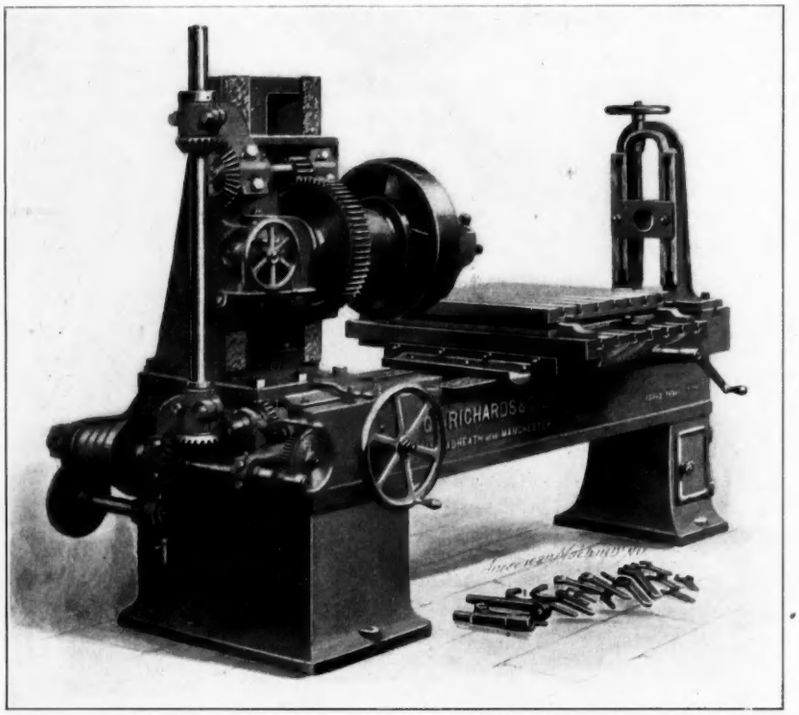


FIG. 58. PIPE-FACING MACHINE SHOWN AT PARIS BY GEO. RICHARDS & CO., OF BROADHEATH.

AN IMPROVEMENT IN SCREW-CUTTING DIE HEADS.

An improvement in screw cutting is also shown by the Acme Machinery Company, of Cleveland, Ohio, although in this case it applies to such screws as are cut by a die, but where a lead screw is used to secure accuracy of pitch, and where a superior class of work is to be done. The Acme die head has been fully illustrated in our columns, and it will be recalled that at the end of the cut it is opened automatically or by hand. This is done by means of the yoke which is seen passing around the die head in Fig. 57, and which is pivoted at the top. The improvement consists in arranging this pivot so that it is movable and adjustable by a screw, and thus this screw becomes a means by which the die is accurately adjusted to size, and not only that, but turning this screw at the beginning of a cut so as to move the pivot of the yoke a little forward; then, after a cut has been taken, turning the screw to its normal position against a stop makes the die cut to the finish size, so that by this means a die is made to leave a little stock for a finishing cut where it seems desirable, and many screws can therefore be made by the machine which could not be made good enough by a single cut. The Acme Company has one of its forging machines in operation at Vincennes also, heating the stock for it by means of a furnace made by the American Gas Furnace Company.

A "PIPE FACING" MACHINE.

A tool which has proven quite successful from both the mechanical and commercial standpoints in England, but which is not known at all in America, is exhibited at the Champ de Mars by George Richards & Co., of Broadheath, near Manchester, England. This machine is shown at Fig. 58, and it is called a pipe

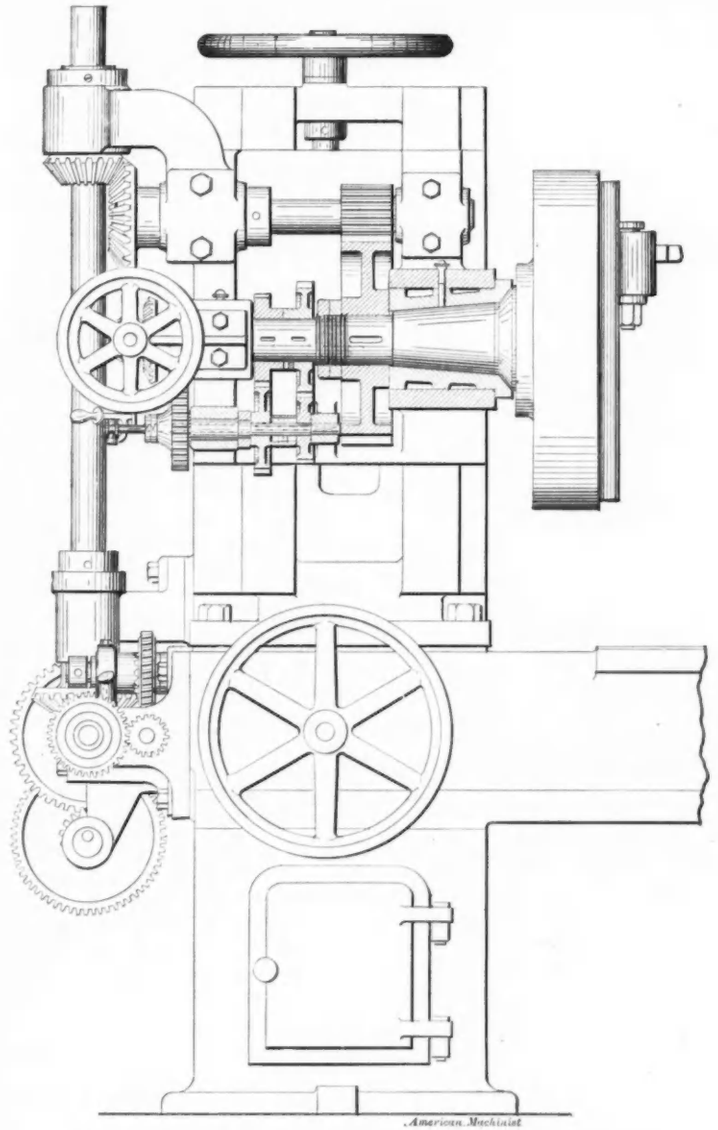


FIG. 59. SECTION THROUGH SPINDLE OF PIPE-FACING MACHINE.

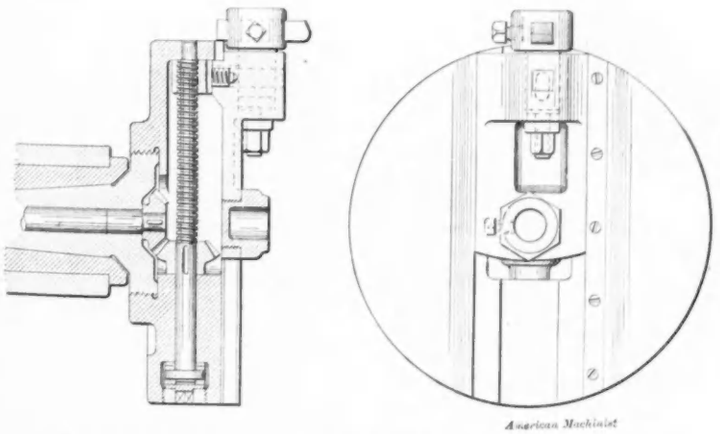


FIG. 60. SECTION THROUGH FACING HEAD OF PIPE-FACING MACHINE.

facing machine, although the name very inadequately describes the tool, which is useful and efficient for many other kinds of work as well.

In facing the flanges of pipes the work is secured to the platen of the machine, and the platen is then adjusted horizontally and the saddle on the upright vertically, to bring the spindle and the work approximately concentric. The facing tool is then set in action, and is fed radially by the mechanism shown in Fig. 59, which is a section through the spindle bearings showing a portion of the feed mechanism; the rest of it being shown at Fig. 60. The standard seen at the other end of the bed in the photograph is removable, and when it is taken off it is, of course, obvious that work of any length can be secured to the platen, and as the work does not move while being faced, the means of supporting the outer end, where it is excessively long, may be very simple.

In addition to this facing, however, the machine can bore, because there is an automatic feed for the saddle upon the bed and means are provided for properly supporting and driving a boring bar. Also, by putting upon the platen a simple slide rest pulleys may be bored and turned and other lathe work done; an automatic feed which is applied to the cross platen making the machine also available for such face and other milling as cannot be done by the movement of the slide attached to the spindle. The upper platen swivels to place the work at any desired angle. The machine might be called a universal lathe, and ought to be very useful in a jobbing shop, or in such an establishment as are in England called "engineering works."

A BORING AND TURNING MILL.

At Fig. 61 is shown a boring and turning mill exhibited by the same firm. Its main features will be readily apparent from the photograph, and it will be noticed that a friction feed drive is used, by which "steps" in changing the feed rate are avoided, and the range of feeds provided for is from the finest ever required to ¼ inch per revolution. The spiral gears used in the feed motion are not put there for the reason that such gears are used on the Continent, but because the larger one of the pair is utilized as a worm wheel, the motion of the friction wheels being in this machine (as undoubtedly should always be the case) relatively very fast, to give ample driving power for the feed motions. It will be noticed also that the arrangement is such that the driving power or force transmitted to the vertical feed shaft is the same whether the feed be fast or slow. Both feeds are reversed from the end of the cross rail and the vertical slide is handled from the same place. The platen is set over to one side in order to reduce the overhang and bring the working side of the table under the center of the cross rail, which is made long enough so that the saddle can be run out far enough to turn down the edge of the largest piece the mill will swing.

A RADIAL DRILLER WITH TAPPING SPINDLE.

At Fig. 62 is shown a radial driller with tapping spindle that is exhibited by the firm of Kendall & Gent, of Belle-Vue, Manchester. This firm, which has recently erected splendid and good shops at the place named, now includes in its per-

sonnel no one named either Kendall or Gent. Samuel Dixon is the engineer director, and this machine was designed by him, its special features being patented. The point in which it differs most from the usual machine of its type is in having the tapping spindle so arranged that the drilling and tapping of holes can be carried on continuously without stopping or changing the machine, and also without changing the drills or taps in passing from one hole to another. As soon as a hole is drilled, the tapping spindle, running at the correct tapping speed, can be brought by a single movement over the center of the hole. This is accomplished by having two spindles on the saddle running at proportionate speeds, one for drilling and the other for tapping, and so arranged that one complete turn of the hand wheel exactly replaces the drilling spindle by the tapping spindle, and a stop which can be set when drilling insures just one turn of the hand-wheel. The drilling spindle is carried in conical main bearings, is counterbalanced and provided with quick hand and power feeds.

The drilling spindle always running in one direction, avoids the wear and tear upon the keys, belts, etc., of constantly reversing.

The tapping spindle has a reversing motion for withdrawing the tap at twice the tapping speed, and, to avoid breakages of taps, is provided with an arrangement by which the spindle stops automatically as soon as the tap reaches the bottom of the hole or if the hole be too small, and this also enables studs to be screwed firmly home without risk of damage.

The end of the tapping spindle being entirely free from encumbrance or large diameter, and the spindle being adjustable to any length, enable holes to be tapped in a minimum amount of space, and in positions often quite inaccessible to other machines. This spindle can also be used for counterboring holes drilled by the other.

The vertical adjustment of the radial arm on the upright is rapidly accomplished by power acting through friction cones controlled by hand-wheel on the side of the machine.

The driving is by electric motor, compactly arranged at the back of the machine and running at a constant speed, a graduated series of eight positive speeds being provided, any one of which can be instantly brought into use by the hand levers at the side of the machine.

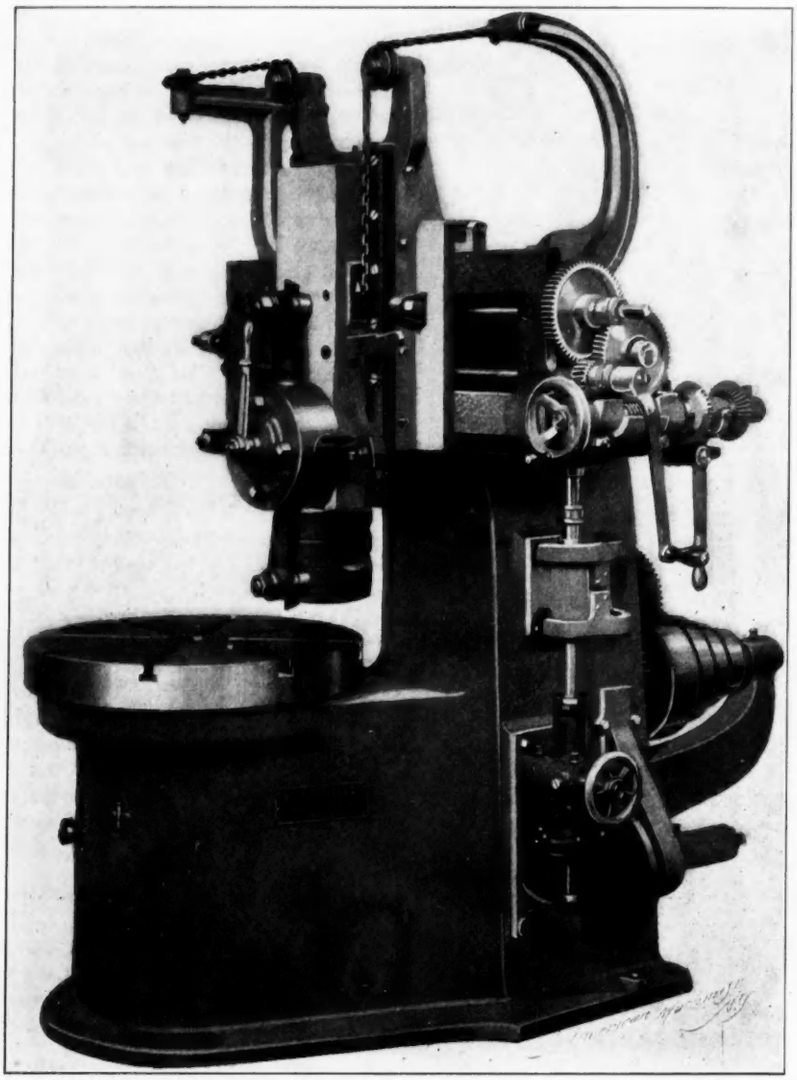


FIG. 61. BORING AND TURNING MILL SHOWN AT PARIS BY GEO. RICHARDS & CO., OF BROADHEATH.

A MILLER OF THE PLANER TYPE.

A milling machine of the planer type, which is exhibited by the same firm, is shown at Figs. 63 and 64, and this machine represents a type which is, and for some time past has been, much used in British locomotive and other engineering establishments. The machine exhibited is of necessity one of the smaller sizes (weighing fourteen tons and being for work 10 feet long and 4 feet wide and high), but its design is practically the same as the larger ones built by the same firm, which extend up to machines that are 30 feet long. This machine has been designed for and is used upon work that was formerly done exclusively upon the planing machine, and it is the particular form of miller that is especially the competitor of the planer. Automatic feeds ranging from ½ to 3 inches per minute for the platen and saddles enable work to be milled upon five sides at one setting. There is an attachment which enables a horizontal spindle to be used when desired, and there is also a circular platen with automatic feed that can be readily placed in position or removed. The cross-rail is moved upon the uprights by power, and there is also a rapid traverse movement for the platen. In Fig. 64 are seen two cutters in place that are for taking a cut such as has been previously alluded to, and which we do not employ very much in America. The supports for the lower ends of the arbors are so made that they can be swivelled about the arbor and set in the most advantageous position that will clear the work. All movements are provided with graduations for accurate setting. The spindles are supported in conical bearings, and the lower bearing is adjustable vertically with the spindle to set the cut. The machine is driven by a motor running at constant speed and with eight changes of speed provided for by gearing.

The vertical spindle miller shown by Fig. 65 is also the medium size of a line of similar ones built by the same firm, the distance from the center of the spindle to the frame being 26 inches and the hight of work taken on the platen 24 inches. The photograph shows the machine so plainly that little is needed by way of description. The exposed portion of the spindle which is seen in the engraving is 4 inches diameter, and it is larger in the lower bearing. Both bearings are conical and the lower one adjustable vertically to set the cut. This vertical adjustment is made by means of the pilot-wheel at the side of the machine, which moves the two vertical screws

through the medium of the helical gears. The lower end of the spindle is supported by a bearing which is at the end of an arm provided for the purpose, and this arm can be attached by links to the movable arm above it, so that both are moved together when desired by the pilot-wheel previously referred to. This lower arm is also pivoted at one side, so that when it is wanted or would interfere with the work, as sometimes happens, it can be readily swung around out of the way. This same arm also carries a roller to be used in milling irregular forms by a template fastened on the platen, and when such work is to be done, the longitudinal traversing screw can be arranged to move freely endwise; a weight being attached to the saddle to maintain contact between the template and the roller. The feeds range from ½ to 3½ inches per minute, and there are graduated rules and pointers fixed to all the slides for the purpose of facilitating the setting of cuts. F. J. M.

Foundry Management.*

BY JOS. A. MURPHY.

Few men run foundries for the good of their health; they, like every other branch of industrial enterprise, are run to make money—not for the pig iron and coke dealers, foundry supply merchants, or the help that is necessary to conduct them (though in many cases the lion's share of the profits go to the above mentioned), but for the owner's own pecuniary profit. Upon this theory all start out with more or less of a flourish to do business, and our success depends upon our plant and its location, management, material and tools.

Granting that the location is all right, the architectural design of a shop has much more to do with its efficiency than is generally supposed. Light is the all important thing that is wanted on the foundry floor, just as much as mental light is wanted on foundry subjects by a great many. Sand is a bad conductor of light, and everyone knows it. Then why is it so many foundries are almost dark? You would not expect your typewriters to produce a letter free from typographical errors if the keys had to be touched in semi-darkness. Your bookkeeper would not attempt to balance or make entries in your books under the same conditions. The chances are that everyone in your office has an incandescent lamp over his desk to turn on when needed. An office force is to a great extent unproductive, although a necessary expense. All the more reason why you should give the productive portion of your employees at least as much light as the unproductive. Do you think a molder can do as much work in semi-darkness as he can with good light? Don't you think it takes time trying to turn the sunny side of an old oil torch on some particular part of a job, ramming with it, setting gaggers with and finishing a mold with its aid? Bad light is very irritating to a molder, and many the time after he gives some portion of his mold a few slicks he will say, "Oh, let it go; can't see it without light." Rough and bad castings can often be traced directly to bad light. Would it not be better, more healthy and more economical for all concerned, to devise a means of conducting the free and pure light into the foundry than to be every day large and indirect contributors to the scrap pile? Simple matter to do it. The railroad stations furnish some splendid examples. Have a section of the roof made of wire glass and you will get the most satisfactory returns. I know of one foundry that admits light in that way, and the results are excellent. Light and ventilation are all important to the success of any foundry. These, with the total or partial abolition of the smoke nuisance, should be of prime consideration.

Much could be said under this caption that the limits of a brief paper like this necessarily curtails. My own experience being entirely in the machinery and jobbing foundries, I consider a competent foreman as the chief feature, one who himself is a first-class all-round molder, not one who is first-class in some special kind of work, as a man who has had experience in only one or two shops in his lifetime is very apt to be. Avoid the specialist, as he is of necessity a one-faculty man who is liable to prove himself a white elephant in any shop where the class of work is continually changing. A man of broad experience, good education and address, temperate in habits and language, firm and polite in his demeanor, generally is a student of human nature and has executive ability of a broad gage character at his command, and is sure to produce the very best paying results in any shop that is fortunate enough to employ him.

Men can be led much easier than they can be driven. For polite requests, kind answers and gentlemanly bearing of a foreman, men will exert themselves to the utmost to do the square thing and to oblige. Men will always kill time on the bulldozer if they can. I have worked in shops where the foreman cursed and blasphemed nine hours out of ten, and who created so much confusion around casting time that one-third of the shop's work was always lost. Such foremen are cordially hated by their workmen, and in good times, such as the present, they cannot get good men to stay. Result—more bad work and more loss for the owners. Every man kills all the time he can, and is actu-

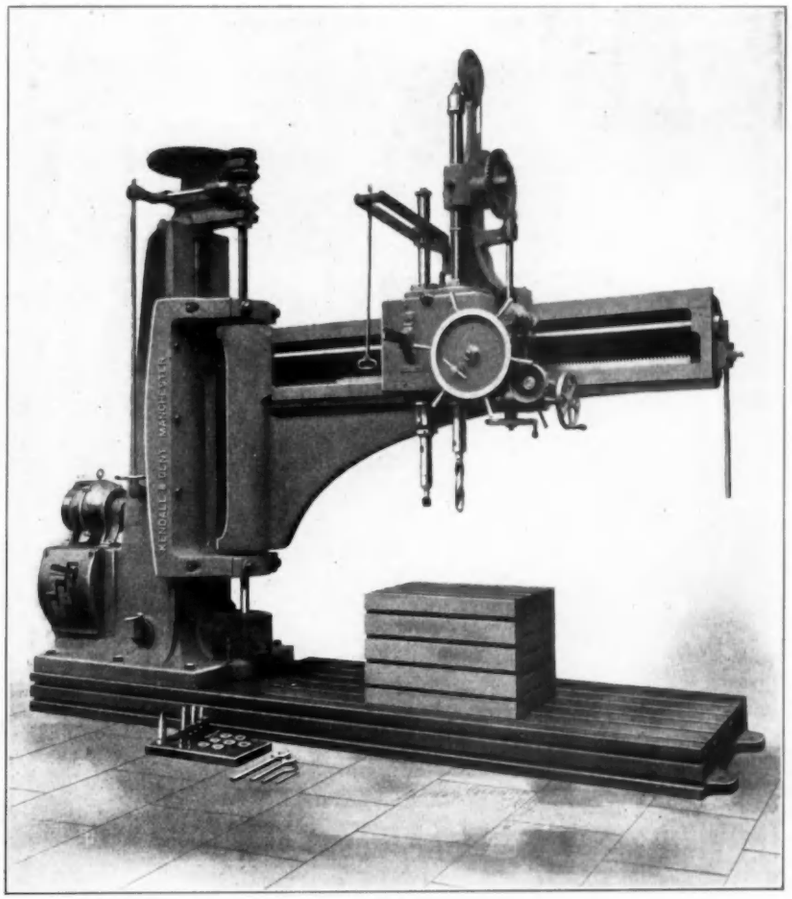


FIG. 62. UNIVERSAL DRILLER WITH TAPPING SPINDLE SHOWN AT PARIS BY KENDALL & GENT, OF MANCHESTER.

* Presented at the Chicago meeting of The American Foundrymen's Association.

ally glad in his heart when castings get lost, so as to get the tyrant into trouble.

On the other hand, there are shops where the foremen are greatly respected by their men and there is no length to which they would not go to help them get their work out. You never hear good foremen yelling and shouting, and as a consequence the men don't shout either. You never see any confusion around casting time—that particular time when every man wants to have his head about him. You see very little work lost in such shops, and you invariably see the maximum quantity of work turned out. I ask you the question, which of the two classes of men are likely to make your shop pay best, the cool-headed, educated gentleman, with his system always, or the blatant rule-of-thumb fellow, with no system but his "hollering," fretting, fuming and growling?

You want the greatest possible amount of work you can get out of your men; that is natural. The more work you get out of each and every individual, the bigger and better your bank account grows. Now, what do you do towards that goal? Many of you do what is right, of course; but there are quite a number who do nothing at all other than sing out from the office, "We got to have more work." Did it ever occur to you that every molder in your shop spends over an hour every morning in the year doing laborer's work, pulling out castings, cutting sand, mixing facing, etc., and many other hours during the day skirmishing around after gaggers, parting sand, rammers, brushes, riddles, and fixing up old flasks that should be fixed before the job was given out?

Cutting sand in the morning is a bad appetizer for a square day's work. It is the hardest hour of the day, and a tired man means carelessness, and the chances are you may have an addition to the home-made scrap pile that you would not have had if the molders had been feeling as men should feel about their responsibilities. A tired body always carries an inactive mind. You would be more in pocket to keep a molder molding. Castings are money to you. If the conditions of your shop are such that a molder cannot start molding before 8 o'clock, why, you have lost the equivalent in value of the castings that he would have produced in that one hour. Laborers should do that work. Some of you, no doubt, will say: "Well, if we did get the sand cut up our molders would not do any more work anyway." Why? let me ask. What is he going to do with that extra hour you gave him, which is to his benefit as well as to your own? If you can't get as much molding done in that hour as in any other, it bespeaks bad management, for which you can blame none but yourselves.

You pay a molder 30 cents an hour, and a helper 15 cents on an average. For every hour you keep a molder doing laborer's work you lose 15 cents on time alone, not to speak of the profits on what he would have produced in castings. If you have fifty molders, each doing an hour of laborer's work every morning, you lose on time $6.50 per day, $39 a week, or over $2,000 a year. That would pay a good foreman. You will also probably say: "That sounds nice as a theory." I have seen it in actual practice in more than one shop, and I know that it pays. All it requires to get it in working order is a foreman in sympathy with the movement and with executive ability enough to inaugurate a system. If you are not making the money you ought to make, just look into this matter. A small expenditure at the start will pave the way to a system of general economy. I know of

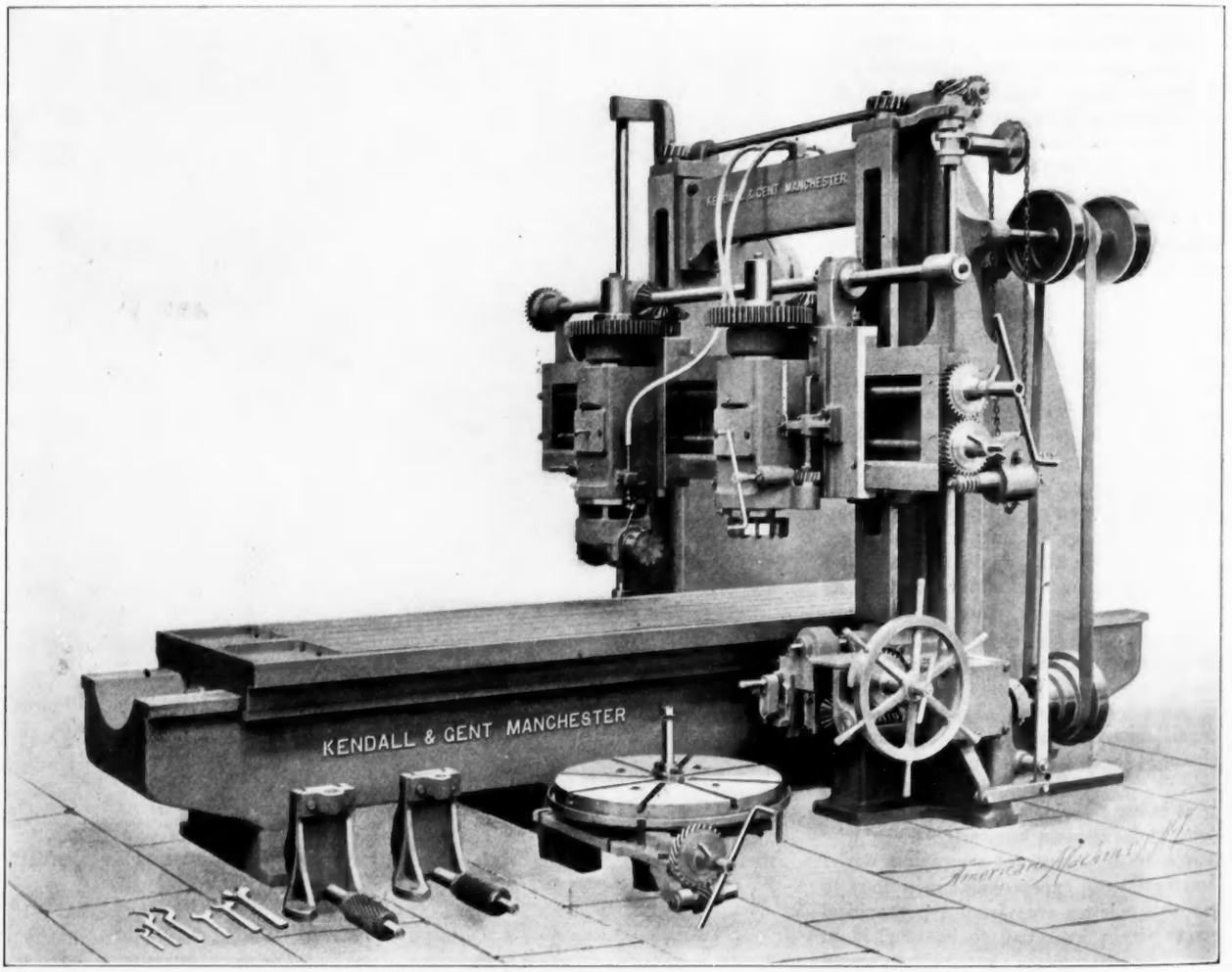


FIG. 63. MILLING MACHINE OF PLANER TYPE SHOWN AT PARIS BY KENDALL & GENT, OF MANCHESTER.

shops where molders do not do five hours actual molding. Does this pay? The molders don't like it; they often leave, as they say they can't get anything to work with, so, figuratively speaking, it is bad for master and man.

There are true and false economies, and it takes a practical man to discern the difference between the two. Anyone can see it sometimes. The one aim in every foundry should be for a system. You would have less bad molders if you made an earnest endeavor to improve them. The great majority of them don't read; they are of a mechanical nature. A number of you are not very far advanced as far as reading matter of interest to the foundry is concerned. The molders' mechanical and intellectual improvement will surely be to your benefit. Do you do anything in the matter? I have never known of it.

Sand should demand the greatest care in its selection. A good, strong, refractory open sand is of prime necessity in any foundry, for with poor sand much time is lost, and many castings as well. A great deal of time is lost in venting work which would be unnecessary in many jobs with good sand. Scabs, even if they do not spoil a casting entirely, look bad and cost money to chip off anyway. It is more difficult than many of you imagine to keep bad sand from scabbing, and cutting where the flow of the metal is greatest. I have worked in shops where with ordinary care a casting never scabbed, and again in others where with extraordinary care castings often were covered with scabs.

About the first thing a new molder will ask his partner when he starts in a shop is about the sand. If told it is bad, he invariably spends more time on his mold, and any molder who has had experience in a good many shops is always ready to admit that it takes him a week or more to get on to its eccentricities. There are many dead losses in the foundry through the medium of bad sand. The difference in price between good and bad is very little, but the difference in results, if figured up, would be astounding.

Dry sand should be better understood among foundrymen. Castings are rarely lost in dry sand if handled by competent men. It costs a little, of course, to dry a mold, but with scarcely any risk of loss, and a better and stronger casting goes a long way in compensating for the little extra cost. It is an open question whether in many classes of work dry sand is not the cheapest, all things considered. A dry sand mold is always made quicker by a man that knows his business, and the materials used need not be half as costly as they sometimes are.

Sweeping work is a good and cheap method which many of our foundries do not practice. They let good jobs pass their doors. Work can be swept up in green sand, dry sand or loam; but, of course, a knowledge of drawing is necessary on the part of the foreman and molder. Loam is often the cheapest way of making some castings, and the bricks should be of a soft quality and the sands of a good grade. Some shops go to a great deal of unnecessary expense in making loam. As good a loam as I ever used was composed of five parts loam sand and seven parts fire sand, wet with clay, wash well, mixed and left lay for a day or two before using. Horse manure, sawdust and the like make it hard to mix, hard to finish, and are unnecessary as component parts of loam mixtures.

Every foundryman tries to get pig iron suited to the class of work he turns out, and generally the best suited to that purpose. Great attention is often paid to the iron. Physical and chemical tests will be made, which will prove all right, but still the castings come hard, spongy, brittle,

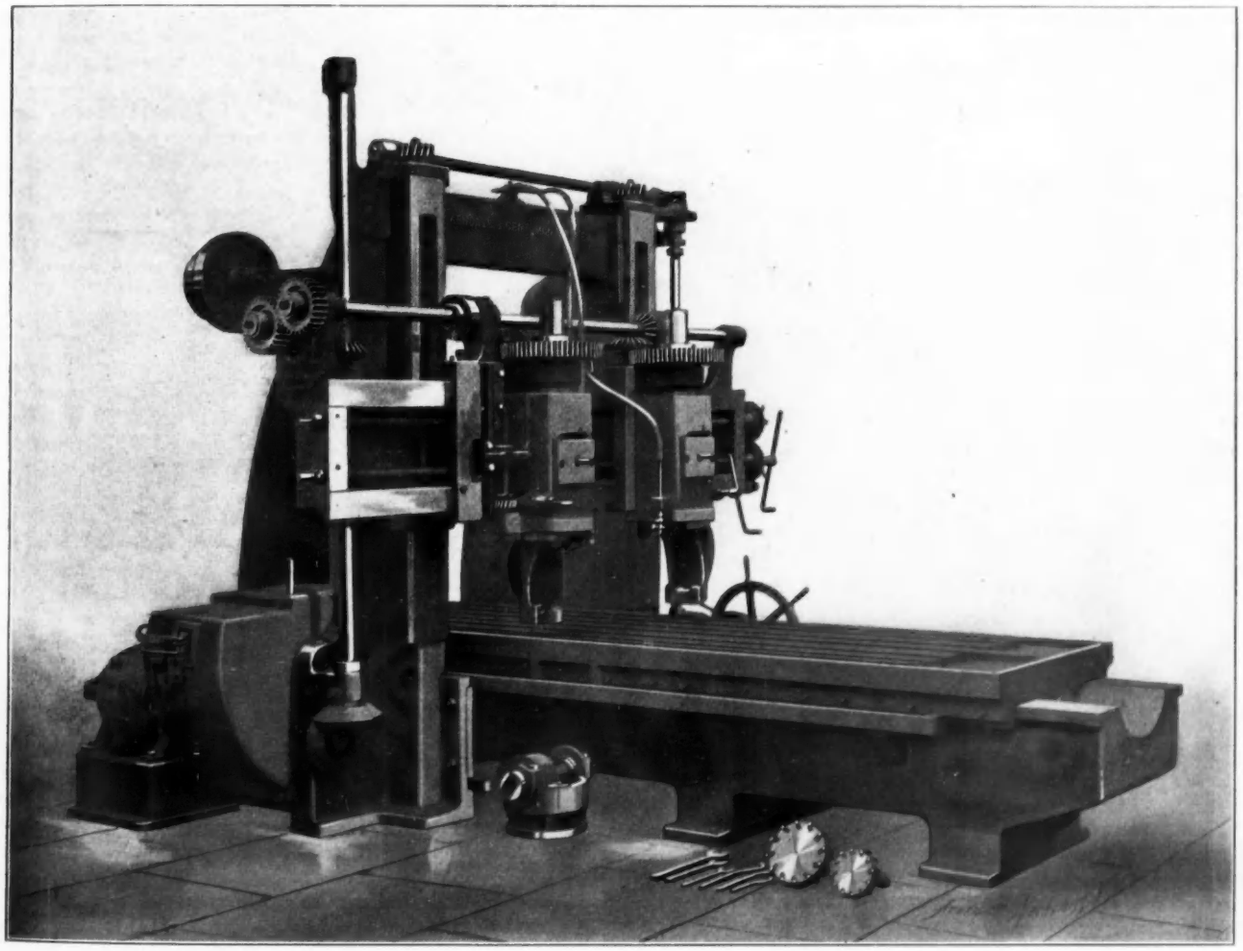


FIG. 64. MILLING MACHINE OF THE PLANER TYPE SHOWN AT PARIS BY KENDALL & GENT, MANCHESTER.

and often crack. Iron is easily spoiled in the cupola. We pay for good iron and endeavor to see that we get what we pay for, devote a lot of our time to compounding mixtures, and pay no attention to the quality of our fuel. I have known shops to have the best of iron and get poor results. The reason is often found in one single lump of coke. You may discover some yellow spots plentifully distributed all through it. That's sulphur, and a mighty poor thing to come in contaminating contact with melted iron. The fuel should be examined for defects just as severely as the iron.

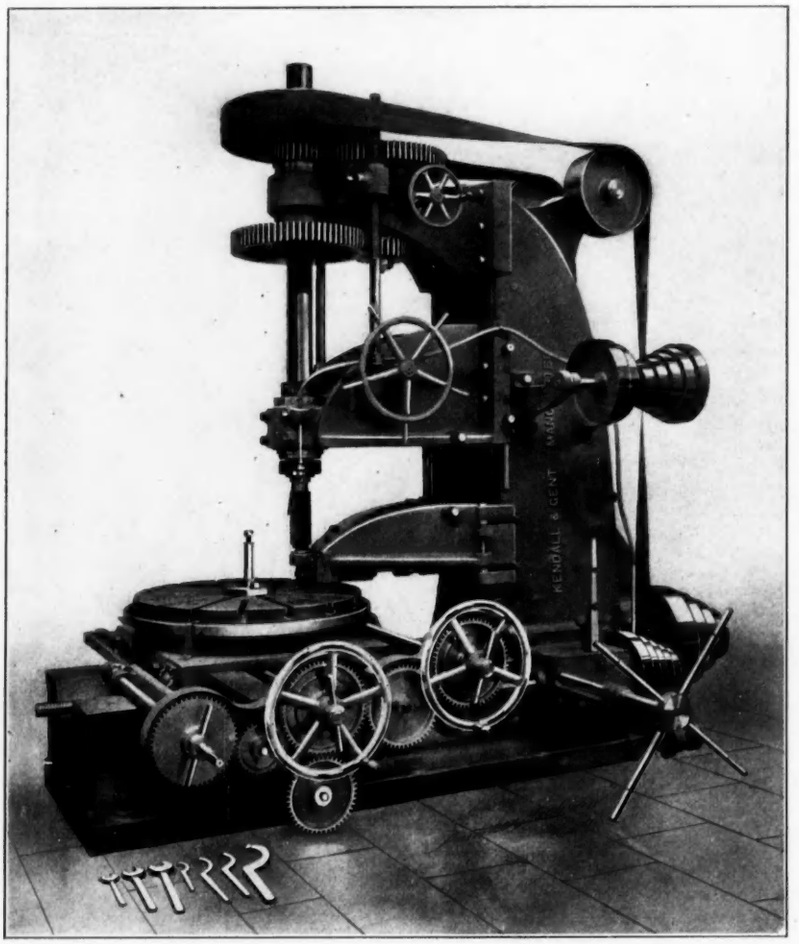


FIG. 65. UPRIGHT MILLER SHOWN AT PARIS BY KENDALL & GENT, OF MANCHESTER.

Plumbago blacking, it seems, is only a memory. Molders hardly ever see or handle any nowadays. Substitutes have largely taken its place, for, like any other article that is dear, a substitute is sure to be provided. The blackings of the present day are composed to a great extent of common cement, pulverized anthracite, charcoal, soapstone and other cheap minerals, and it is a question if they do not cost more than they are intrinsically worth. Some of them peel very well indeed, but the great majority of cheap blackings do not peel well and are difficult to work on a mold. It would be worth while for someone statistically inclined to figure out how much longer it took a molder to properly slick up a mold—if such a thing is possible—with a poor blacking than if he had a good quality, and see if the difference in time, not to speak of the results, would not buy a good article. Castings are certainly much harder to clean with poor blacking. If the sand fuses—as it is sure to do on heavy work—a very bad job is the result, and in addition to the molder's extra time on the mold, it costs more to clean the casting, and then the results are not fully satisfactory to anybody concerned, oftentimes resulting in the loss of a valuable customer. Every foundryman should strive for that which will give his shop the name of turning out the best and nicest castings in his vicinity. 'Tis a kind of policy that easily pays, particularly shops that handle machinery castings.

Assuming the fact—which is not always the case—that every shop is equipped with appliances commensurate with the financial circumstances of the firm, we will leave that matter at present and devote a few moments to the more common, every-minute, indispensable tools used in the shop, and of which there exists such a plentiful scarcity in many foundries. Shovels, riddles, brushes, rammers, clamps, gaggers, rods, wedges, weights, etc. To get the maximum amount of work, or to expect it of a man, he should have access to the above tools without looking around the shop for them or waiting until someone else is done. Every molder should have at least a good shovel, two riddles, a pail, a brush and a rammer, and if it is necessary—as is sometimes the case—hold each man responsible for their condition and safe keeping, but if you do, add a proviso to discharge the first—and all after the first—person stealing any of the above articles.

The other things are more generally held as common property, and any shop is money—and a good deal of it—in pocket to have plenty of them. Have you ever seen a molder wait an hour until someone else was done with a rammer? Have you ever seen him wait until the last minute until someone else got poured, so as to get the clamps, not half clamp his job, have it run out, burn the flask and lose the casting? Ever see a man a whole hour hunting up a handful of gaggers that someone else had buried in the floor for safe keeping? Probably you haven't. Probably if you did you would not notice it. In some shops this hunting around and waiting for everything is a necessary detail of the business. It does not pay, and I challenge contradiction. Though you may think you are running cheap, you are running dear, and you would find that it would pay you better and your molders would like you more if you kept them molding, instead of having them chasing around after the tools you should supply them with. For a scarcity of clamps, gaggers and such tools as can be made with scarcely any cost in the shop, there is no excuse other than that of bad management.

The steamer "Paris," of the American Line, is being not merely repaired, but reconstructed at the Harland & Wolff yards, Belfast. She is receiving an entire new bottom and new engines and boilers. Her power and speed will be increased. There will be little change in her exterior appearance, except that she will have two funnels instead of three. The diameters of the cylinders of the quadruple expansion engines will be successively as follows: 38½, 54, 76 and 106 inches, with a stroke of 5 feet and boiler pressure of 206 pounds. The stern of the steamer is to be rebuilt so that the twin screw shafts will be encased in the hull instead of being hung on struts as before. The steamer will be renamed the "Philadelphia."

Causes tending to diminish the production of wrought iron seem to be operating in both directions against it. Not only is the demand being constantly diminished by the use of steel instead of wrought iron, but it is reported in Great Britain to be increasingly difficult to obtain puddlers. Wages are high, but the work is hard and men prefer to work in the steel furnaces.

The Construction of "Long Cecil" at Kimberley During the Siege.*

BY EDWARD GOFFE, OF KIMBERLEY.

The object in view was to make a gun of greater power than those possessed by the garrison, which were 2.5-inch R. M. L. guns (7-pounders), and were not big enough to effectually reply to the enemy's 15-pounders, or to make any impression on his works.

A gun of about 4 inches bore, firing a shell 25 to 30 pounds weight, appeared to meet the case and to be possible of construction.

The possession of a billet of hammered mild steel (originally intended for shafting, and ordered as such), 10½ inches diameter and 10 feet long, made by Messrs. Sybry, Searls & Co., of the Cannon Steel Works, Sheffield, and of several bars of 6x2½-inch Low Moor iron, in the workshops of the De Beers Consolidated Mines, really suggested to the late Mr. George Labram, chief engineer of the company, the possibility of making the gun, by boring the steel bar to form the tube, to be strengthened by rings shrunk on, made of the Low Moor iron.

This resulting gun would evidently be of a type similar to an early "Armstrong," heavy for the work done compared with one of a more modern type, but in this case weight was a minor point to be considered, ease and quickness of manufacture being perhaps the leading ideas.

The first difficulty met with was the resistance of the military authorities to the attempt to make the gun, but as this was hardly a mechanical difficulty, further reference to it may be out of place. However, on Christmas Day, 1899, Mr. Rhodes, chairman of the company, gave the order to Mr. Labram to make the attempt. Work was immediately started, and then the difficulty consequent on ignorance on the part of both Mr. Labram and the author, of practical gun design, was first met with. This was overcome by a search in all books available, and the scattered information so obtained was brought together. The sources of information were: the articles on gunnery, etc., in the "Encyclopædia Britannica;" the "Military Treatise on Ammunition" (which had been previously used in gaining informatiton to make shells and cartridges for the 2.5-inch guns earlier in the siege); articles on modern guns in "Engineering," etc., and from the military "Text Book on Gunnery," brought forward by an enthusiastic volunteer officer, and which proved very serviceable. During the progress of the work in the shops assistance was also given in many details of gun-shop practice, the form of special tools used, etc., by several of the employees there, whose previous experience in Woolwich Arsenal, the Elswick Works, and elsewhere, was willingly given to forward the work in hand.

Approximate calculations only were made for two reasons, one that it was not considered necessary to go into very fine calculations when the two principal factors, the powder pressure and the test strengths of the materials to be used were not known, and could only be estimated, recourse being preferably made to comparisons of the performances of similar guns. The other reason was that time was pressing—the designing and supplying of sketches going on simultaneously with the making of the gun in the workshops.

The stock of powder in the town was of many kinds, ranging from "mealed" to compressed cylinders 1⅜ inches diameter by 2 inches long. Most of it had been kept for a long time, much of it over ten years for certain, but it did not appear to have deteriorated, still retaining a good glossy surface.

The cylinder powder (black) was evidently the most suitable for use, but there was not very much of it, so preparations were made to compress the finer powder into blocks, and so form a slower burning powder. The possibility of the compressing not being successful when the stock of cylinders was exhausted and of having to use all kinds had to be faced, but there proved to be sufficient cylinders to provide cartridges as long as the gun was fired.

From data available it appeared that 50,000 pounds to the square inch would be a suitable maximum pressure to allow for, that being about the maximum pressure calculated when using a charge of 5 pounds of powder in the space which would be available for a powder chamber. But while using the slow-burning powder the shell presumably would begin to travel before that pressure was attained. Many charges of 6 pounds were used while the gun was in action, the maximum pressure due to these conditions appearing to be about 90,000 pounds per square inch, but for the same reason probably the actual pressure reached would not much exceed that obtained from the use of the smaller charge.

A powder chamber of 4.25 inches bore it was found would just contain seven cylinders of powder, four of 1⅜ inches diameter and three of 1⅛ inches diameter, their combined weight for 2 inches of

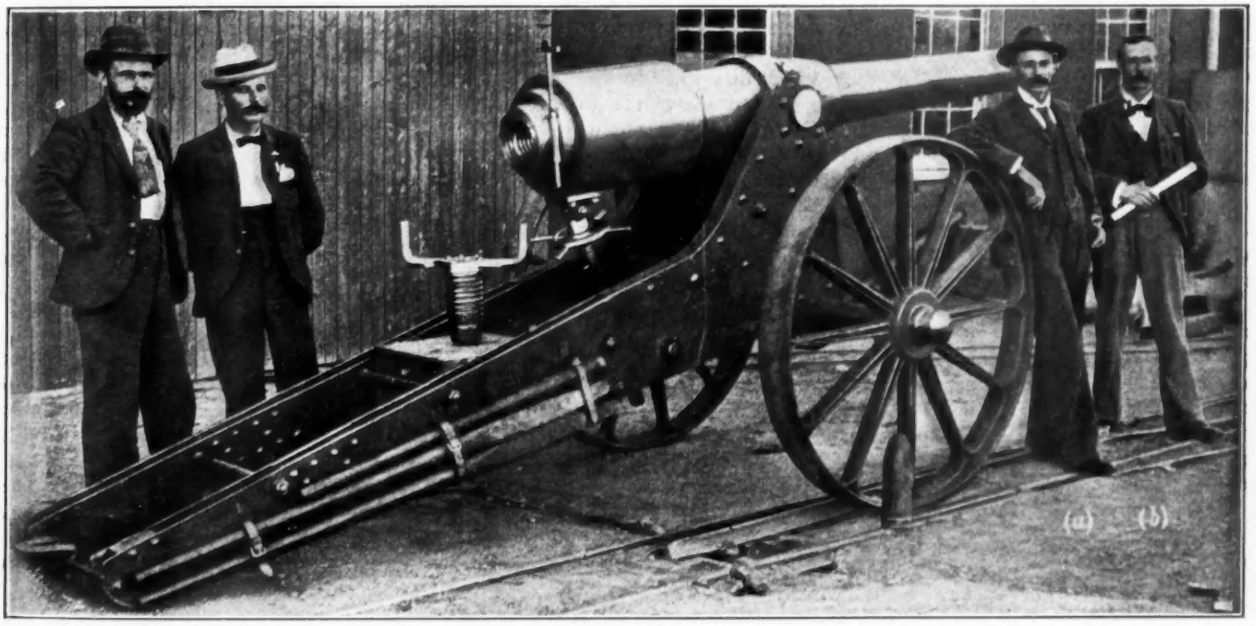


FIG. I. THE GUN AND ITS CONSTRUCTORS.

*Read before the Institute (British) of Mechanical Engineers.

length being just 1 pound. With this diameter to chamber, to obtain a normal air spacing, the length required to be about 12 inches. Next the breech screw must necessarily be about 5½ inches diameter, and allowing a length of thread equal to 1¼ diameters and about 2 inches for obturator, the length of the breech block would be, say, 10½ inches. The total length of the steel billet was 10 feet ¾ inch, so deducting from this 1 foot 10½ inches, the length available for the bore was 8 feet 2¼ inches, very nearly 24 calibres in length.

Upon this basis the strength was next figured out, and the tube alone first taken. Using a formula for the strength of a thick tube subjected to 50,000 pounds per square inch internal pressure, the greatest stress in the material was found to be 70,000 pounds per square inch. This showed, as expected, that the tube could not be used without shrunk rings.

By shrinking on two rows of rings, each 2 inches thick, a reduction of the greatest stress in the tube to about 40,000 pounds per square inch and that in the rings to 20,000 pounds per square inch was calculated, and this it was considered safe to allow. That there was sufficient strength was evident; but the author would like to know really what pressure was attained at any time, the only sign of strain being that the powder chamber has enlarged slightly and is now barrel-shaped, the diameter at the center being fully 1-32 inch greater than as originally made. This is apparently due to direct compression of the metal, as the outside diameter was carefully gaged when an opportunity was given by some of the rings being removed, and was found to be exactly as made.

The order to make the gun was given on the evening of Christmas Day, 1899, and at the start of work next morning the billet of steel was taken into the machine shop. A lathe of 12 inches center, with bed 14 feet long, was used, the extra length of bed required for working the boring bars and rifling gear being obtained by the use of the bed of a similar lathe set in line with it, with the headstock removed. This was already in position, being used when working on lengths of shafting, etc.

Most of the men required on the work had to be temporarily withdrawn from the redoubts where they were stationed, forming part of the Town Guard. During the building of the gun and making of ammunition the workshops were always under fire from the enemy, many shells, including 94-pounders, bursting around and passing over the buildings, none, however, actually doing damage; but it was very trying for a man to stay at work at a lathe or other machine, hearing shells bursting around, and not knowing whether the next would come inside or not, and all those who had that experience deserve appreciative mention for the way in which they stuck to their posts.

[Fig. 1 shows the gun complete. Mr. George Labram leans with his arm on the wheel, and Mr. Edward Goffe, the chief draftsman and author of this paper, stands beside him.—Ed.]

Fig. 2 shows the general construction of the gun. The steel billet was first turned all over outside, a shoulder of ⅛ inch being made to take the thrust of the trunnion ring, the largest diameter being 10.5 inches. It was turned tapering towards the muzzle, a parallel part about 9 inches long being left there to be used as a journal when boring. For boring, the breech end was held in a dog chuck with the muzzle revolving in a hardwood bearing, and first a twist drill 1½ inches diameter was put right through. This was followed by a twist drill 3 inches diameter; then the end counterbored with a tool, and a boring bit, Fig. 7, started, enlarging the hole in one cut to 3 15-16 inches diameter. The bit was plentifully supplied with water through the bar, which was one belonging to a diamond boring drill. All went through without any special difficulty, but experience showed that the boring cut was too heavy, and it would have been better to have taken two cuts for that amount.

While this turning and rough boring was being done, which occupied about a week, the rings were being forged, nine being wanted for the first row, 10¼ inches diameter inside (less shrinkage), and four wanted for the outside row, about 14¼ inches diameter. These were all made from the 6-inch by 2½-inch Low Moor iron, a length of bar being cut, bent to a circle, and the ends welded together. As these were finished they were passed on to the machine shop, where they were turned, faced and bored to gage.

The trunnion ring was a greater undertaking than the plain rings, and the difficulty of making a satisfactory weld in so heavy a piece of work, with the appliances at his command, was overcome by the leading blacksmith, by working it out of a length of 6-inch by 6-inch Low Moor iron, starting a small hole through the center, and enlarging by successive heats until he had it to the required size for machining.

By the time the rings of the first row with the trunnion ring were made, the tube was ready to receive them. For shrinking, the tube was held vertically under a convenient derrick in the yard, first with breech end upwards. The ends of the bore were plugged, and a circulation of cold water arranged inside to keep the tube cool. The rings were heated on a plate over a wood fire, the bore being gaged until sufficient expansion was evident, then lifted by the derrick over the end of the tube and dropped into place, the trunnion ring being the first to go on,

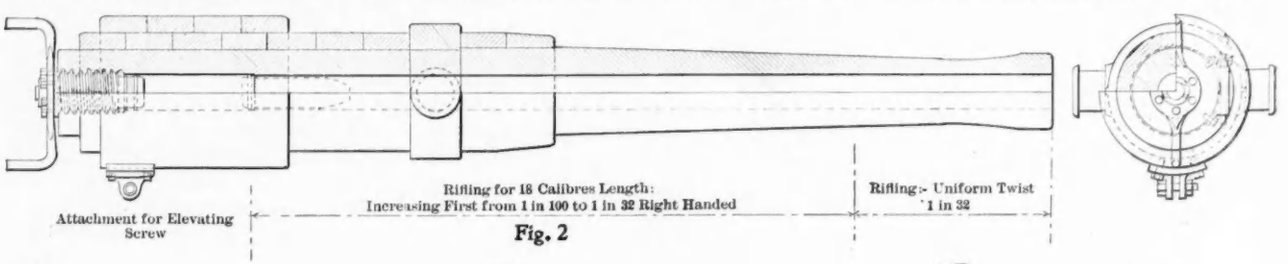

Attachment for Elevating Screw
Rifling for 18 Calibres Length: Increasing First from 1 in 100 to 1 in 32 Right Handed
Rifling:- Uniform Twist 1 in 32

Fig. 2

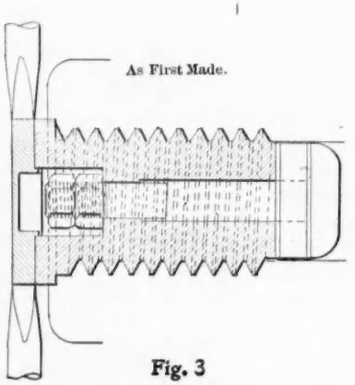


Fig. 3

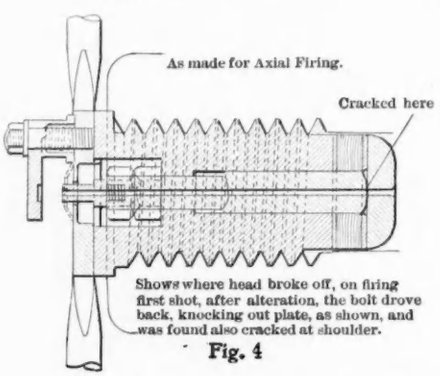

As made for Axial Firing.
Cracked here
Shows where head broke off, on firing first shot, after alteration, the bolt drove back, knocking out plate, as shown, and was found also cracked at shoulder.

Fig. 4

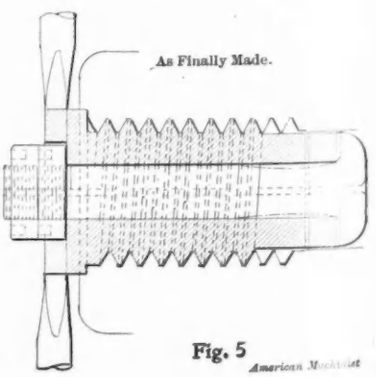


Fig. 5

DETAILS OF THE GUN AND OF THE BREECH BLOCK AND OBTURATOR.

resting against the shoulder. As a precaution against possible travel endways while cooling, each ring was clamped by longitudinal bolts, and the adjoining one on which it rested kept cooled by a stream of water from a hose. The tube was reversed to put on those rings in front of the trunnions, and, the whole of the first row being in place, it was returned to the lathe, and the outside of the rings turned up to form a seating for the second row over the powder chamber. The process of shrinking these was the same as for the first row, and when they were on, the barrel was again returned to the lathe for finishing.

The final boring was then begun, the tool used being a studded bit with double-ended cutter, Fig. 8.

Meantime, the question of rifling had been gone into, and, the increasing twist appearing more desirable and easier on the gun than the uniform twist, it was decided to make it so. To effect this the rifling attachment, as shown in Fig. 6, was devised, the idea being given to the author by his remembering one of Sir W. Anderson's lecture diagrams. The author has since learned that this method is still used in gun factories. The drawing shows a channel-iron bolted to two cross channels, which are bolted to the ends of the lathe bed. On this channel-iron the developed curve of the spiral—a semi-cubical parabola—was set out by its ordinates. A planed bar to act as a forme was bent to the curve, and screwed down with countersunk screws. The hardwood blocks, forming the guides to the rack, and bearings for the rifling bar, were bolted solidly together and to the saddle of the lathe. The end of the rack (which was a stock one as used on the washing machines) is furnished with one little roller, traveling on the "forme" bar, contact being kept by a cord attached to the underside of the rack, carried over a pulley at some distance and having a weight at the end. A small guide pulley should be shown on the saddle to allow for the vibration of the cord with the travel of the saddle. The traversing of the saddle was done by the leading screw of the lathe, a small belt pulley being put on in the place of the usual "change" wheel, with a belt from the overhead drive.

A detail of the rifling head is shown, Fig. 9. It was formed of a solid block of steel, turned to fit the bore of the gun, into which the end of the rifling bar was tightly screwed. The tool was able to revolve slightly on its pin as a center, being kept up to position by the set-screw and packing block, which also regulated the depth of the cut taken, while clearance on the return stroke was possible by the giving of the spring. A felt pad held by a washer was attached to the head in front of the tool, while the head drew another wad of felt behind it, to clean the bore of cuttings as made, and a supply of soapy water under pressure was forced in behind the head, the two semicircular grooves being provided to allow the supply to get to the cutting edge. The only serious trouble experienced in the workshop processes was at this point, when it was found most difficult to get the tool to cut properly, and a lot of time was spent in trying to find the reason, three grooves only being got through between about 10 o'clock one morning and late the following night. The material could not be at fault, as it had been found perfectly good, without flaws, and very clean cutting up till then, and new tools and different lubricants were tried, but but no success, until the packing block, which took the pressure off the tool, and which consisted of a small piece of iron, was noticed to be denting, when a new one of cast steel, hardened, was put in its place, and no further trouble was experienced, the remaining twenty-nine grooves being finished in about eight hours from then.

The rifling was started from the extreme end of the barrel at the breech, so that there was about 2 feet of length to spare, to be afterwards bored out for breech and powder chamber, so that should a false start have been made with a groove by accident, no damage would have resulted. After rifling, the bore was lapped out to take off any roughness left by the tool, and then reversed in the lathe and the powder chamber bored out, a double-ended tool similar to that shown by Fig. 8 being used.

The breech-block screw having meanwhile been made, the inside was cut, and the block fitted in. In cutting this thread in the barrel, the question of the ending of the cut inside had to be met, and the simplest way seemed to be to let the tool finish in a clearance hole, and to drill this hole inside. The little drilling machine, Fig. 10, was made, being worked by a gut band from a convenient source of power.

The breech block and obturator are shown in detail in Figs. 3, 4 and 5. The De Bangé system of obturation was adopted, that appearing to be the most efficient and easily made. The obturator pad was made of rings of sheet asbestos soaked in melted tallow, and proved quite successful. The breech block as made first and used with radial firing is shown at Fig. 3. The block was of hammered mild steel, the same material as the tube of the gun, screwed with a V-thread of ¾-inch pitch with flattened top and bottom. The handle-

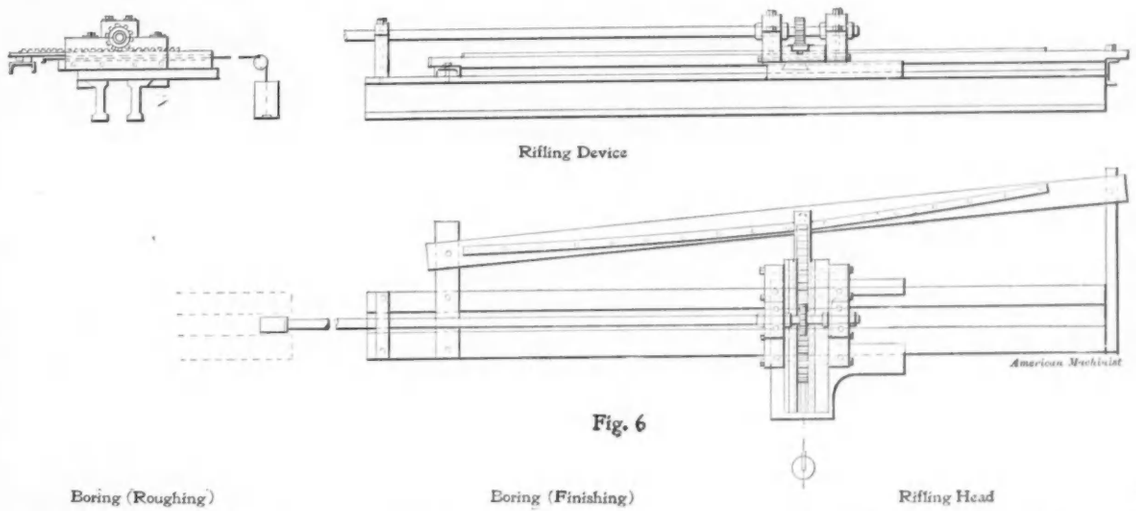


Fig. 6

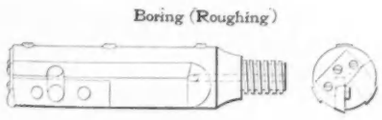


Fig. 7

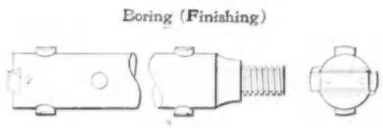


Fig. 8

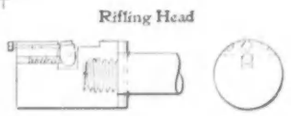


Fig. 9

Fig. 10

RIFLING DEVICE AND BORING TOOLS.

bars and plate are one forging, fastened to the screw with six tap bolts. The obturator bolt with mushroom head was made of mild steel, 1½ inches diameter, shouldered near the middle to 1¼ inches diameter, and held by lock nuts in a recess at the back. As thus made, about 100 rounds were fired with this obturator. Figs. 4 and 5 show it as subsequently made, the reasons for which alterations will be described in due course.

It was arranged originally to have an interrupted screw, cut away in three sections, so that one-sixth of a turn of the handle-bar would release the breech block; but consideration of the time to be saved by not cutting it, which it was thought would be at least two days, and the further consideration of strength, induced the author to urge keeping the screw intact, the actual extra time taken in unscrewing the whole way being only a few seconds.

With the interrupted screw, a safety vent-closing device was necessary, and one was made. One handle, as turned to unscrew the block, moved a plate sliding on the end of the barrel, which by means of a pin working in a diagonal slot closed the vent with a light plate, the reverse action taking place when the handle was turned to screw up the breech, so that the vent could be open when the breech was tight. With the plain screw this was not so urgently required, and although the guard over the vent was retained for a time, it was not used. The vent hole was drilled in the gun barrel after the powder chamber was bored and the breech fitted, and was ¾ inch diameter. About an inch at the top was tapped with ½-inch gas thread, and a copper plug, fitted as tightly as possible for the whole length, being screwed at the end to fit the hole. This copper plug had a small hole drilled through it to fit the friction tubes used.

A relieving hole ½ inch diameter was also drilled through the underside of the barrel from just behind the obturator, to prevent any damage to the thread from the product of explosion, should the obturator ever act imperfectly. But at no time during firing was any smoke noticed coming from it. A flat place true with the axis of the gun was planed on the top for standing the clinometer upon. A gun-metal casting bolted to the underside was cup-shaped to fit the end of the elevating screw, which was turned to a ball. This it was found necessary to replace by a hinge joint, as the gun jumped on firing, and the elevating screw when in an inclined position tended to fall over, and the cup did not come fairly on to the ball end. The back sight, copied from that of one of the 2.5-inch R. A. guns, was provided with a fine traverse for wind allowance, etc., and was set at an angle of two degrees from the vertical (to the right) to allow for "drift" of shell, which was found on firing to be almost exactly correct. The front sight on the trunnion was first made as a bead in a small tube, but was afterwards altered to a knife-edge without the tube. This completed the gun itself, ready for mounting on its carriage, as first turned out of the workshops.

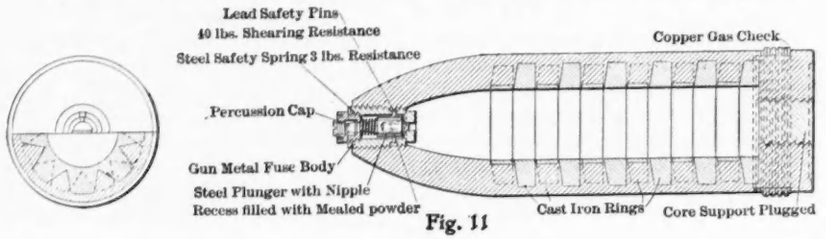


Fig. 11

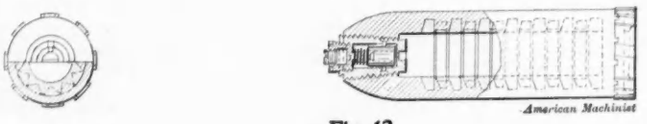


Fig. 12

SHELLS FOR "LONG CECIL."

Carriage.—The carriage having been made in the meantime was ready for the gun. Its general construction is well shown in the photograph, Plate 1. It was formed of four steel plates ¼ inch thick, cut to shape, riveted together in pairs, 2½ inches apart, with distance sleeves on the rivets, and with gun-metal castings also acting as distance pieces and riveted in, for trunnion and axle bearings. The two pairs of plates were bolted together with shouldered bolts, 17¼ inches apart, and with a rubbing plate at the trail end, which was also provided with an eye-bolt for hanging to limber. The elevating screw was of steel, 2¼ inches diameter, with square thread ¼-inch pitch, working in a nut pivoted between the side frames, and provided with a hand-wheel. The axle was 4½ inches diameter keyed into the side frames.

The wheels were the only part not actually made, and they were a pair belonging to a portable engine and suited the purpose admirably. They were bored out, had gun-metal bushes driven in bored to fit the axles, and brass dust caps screwed on outside. The hight of the center of the trunnions from the ground is 5 feet. The center of trunnions is 5 inches forward of, and the point of contact of the trail with the ground 9 feet 6 inches behind, the vertical line through the axle, and the wheels are 5 feet center to center.

With twenty-four days of continuous work the gun was ready, and on January 19, 1900, it was taken out for testing and ranging, a firing platform and redoubt having been built at No. 2 Washing Machine, Kimberley Mine Floors, whence the Boer headquarters (the Intermediate Pumping Station of the Kimberley Waterworks Company) and several of their gun positions could be commanded. The ranging was done with the assistance of the company's surveyors, one having a theodolite at the point of firing, while another, also with a theodolite, was stationed at a point about a mile distant, nearly at right angles to the line of fire. On firing each took observations to the spot the shell struck, and the angle of firing as shown by clinometer, time of flight, charge of powder, etc., also being observed and tabulated, the muzzle velocity was calculated, and range tables made for subsequent use, by Mr. C. D. Lucas. The back sight was not graduated for range, only being used for laying the gun, the firing party preferring to use the clinometer. The enemy appeared much disturbed when the first shells burst in their headquarters, and could be seen hurrying out in all directions, not expecting that they could be reached there, and there was no reply from any gun of theirs during the ranging trial. Mr. Rhodes was present the whole time and personally fired most of the shots, being very pleased with the performance of the gun, and the artillerists working it also were well satisfied with its shooting qualities. The trials having been completed, the gun was returned to the workshops for one or two minor alterations, including a new front sight and altered attachment for elevating screw, as

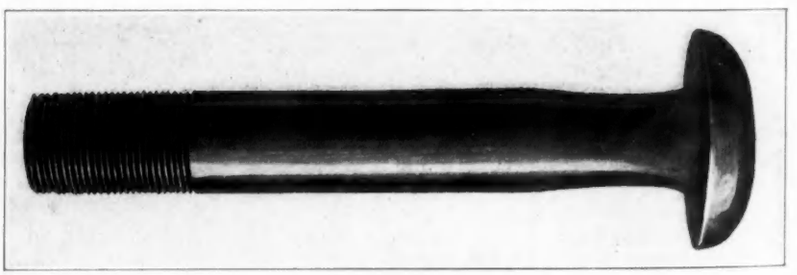


FIG. 13. OBTURATOR BOLT.

already mentioned. These being completed, it was handed over to the firing party and was in action on January 23.

While in action 255 shells were fired in all by it, most of them being at ranges of 5,000 and 6,000 yards, these being reached with elevations of 12 and 15 degrees respectively, with a powder charge of 5 pounds, the shell being 29 pounds in weight. With the same charge a range of 8,010 yards was reached with an elevation of 24° 15′.

Ammunition.—It will be convenient here, before mentioning some further and serious difficulties experienced while the gun was in action, to describe the ammunition. The powder used has already been described. A good wool serge was chosen for the bags to form the cartridges, and they were made by a local draper, being hooped with silk ribbon. The "Ring" shell is shown in Fig. 11. The "Common" shell was similar, the only difference being in the absence of the rings cast in. Both kinds were used, their weight when filled with the bursting charge of 1 pound of powder being exactly 29 pounds. In making the shell the rings were first cast separately, then were mounted on a clay core, alternating tooth and space, as will be noticed, the shell bursting better when thus arranged. This clay core with rings was then used as an ordinary core in the mold, and the metal poured. At first it was tried to cast them with the base solid, the core at that end supported by a "star," but this was not successful, the base being spongy in nearly every casting. Other methods were tried, and that adopted was to core them right through the base, that being downwards, and to pour in at a point about one-third the hight from the end. Sound castings resulted. The cored hole in the base was plugged with a brass plug screwed in tight, and before issuing for service every shell was tested by steam at a pressure of 125 pounds per square inch to detect blowholes, but none failed at that test, and no "prematures" were complained of. The shells after casting were turned to gage, the point screwed for the fuse and grooved for the copper gas check, that being made from a ring turned and cut off to width required, then cut through with a saw, sprung into place and expanded into the dovetailed groove, afterwards being turned and the relieving grooves cut. The insides of all shells were lacquered.

The percussion fuse was devised by Mr. Labram, his idea being to have the simplest one possible to make. The action of it is that when the shell strikes and its forward motion is checked suddenly, the plunger, which is filled with mealed powder, continues its motion forward, its impetus being sufficient to overcome the resistance of the safety spring and wires. The nipple strikes and explodes the cap, which is an ordinary percussion cap as used in sporting shotguns, the mealed powder is ignited and fires the charge in the shell.

It may be mentioned in passing that ammunition, both cartridges and shells—"common" and "ring"—had been made in the workshops and supplied to the garrison since early in November for their 2.5-inch R. M. L. guns, the government supply having been exhausted in about a month. This 2.5-inch shell is shown in Fig. 12.

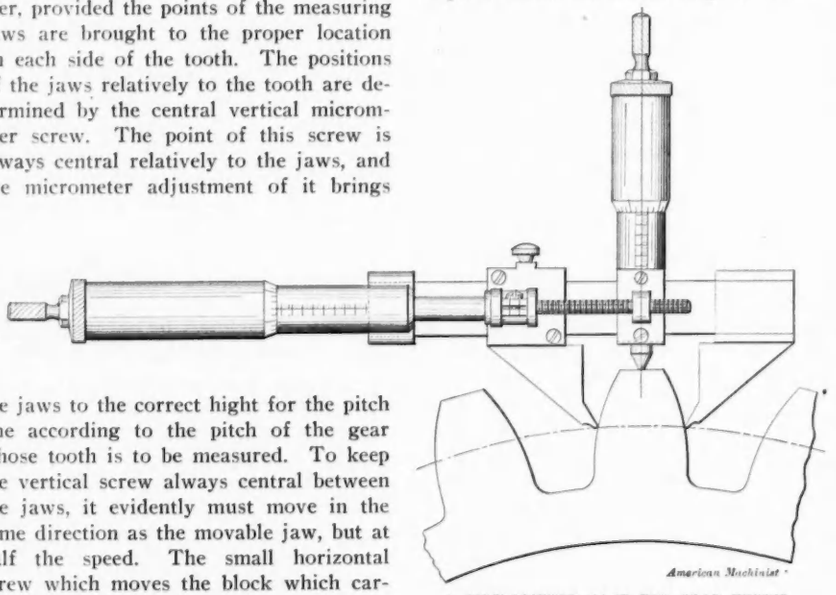
From the time of its being handed over to the firing party, on the 23d of January, the gun was fired steadily, the only trouble being a tendency for the end of the breech block to "upset" and get too tight in the screw. This was easily remedied by first easing the thread and subsequently removing one and then two threads at the end. On Saturday night firing ceased as usual, Sunday being observed as a day of rest—from gun-firing—by the Boers. But at daybreak on Monday morning the first shot fired by "Long Cecil" was productive of an extra loud and peculiar report, and the idea that something had gone wrong was general. A telephonic message came from the redoubt immediately afterwards and an examination showed that the second ring in the outer row had burst through the line of the vent hole. The gun was at once sent down to the workshops for repair.

To take off the first ring the foundry cupola was lighted, the gun hung from the crane with the breech in the sand, and a ring of metal run round the first ring, which in two or three minutes expanded and dropped off, releasing also the broken one, to replace which a forging was already in hand. On removing the gun from the sand a further examination showed that the two rings of the first row immediately under the outer broken one were also broken, these having broken straight across on alternate sides of the gun. To remove these necessitated a repetition of the process, one more outer ring—the third—and the first inner ring having to be expanded. New forgings were put in hand, and opportunity was taken then to make a careful examination of the tube, but no flaw or crack of any sort could be detected, nor any change of dimension beyond the slight barrelling of the powder chamber already mentioned, which does not seem to have increased with subsequent firing. The cause of the failure was not at all evident. Faulty welds were the first things looked for, but in vain; and although in the outer ring one part of the broken surface looked as if it might be an imperfect weld, in the two others there was no mark whatever, and no sign anywhere by which to trace the position of the weld. The outer ring had certainly broken through the vent hole, and from marks on the rings which appeared to be powder-smoke stains, the conclusion was come to that the radial venting was the cause; the copper vent tube, not being tight enough to withstand the great pressure, had allowed the gases to travel around it and get under and between the rings, bursting them by direct pressure, this action being assisted by a combination of favorable circumstances, namely, firing a 6-pound charge of powder for the first shot in the morning, after the gun had been exposed to the cold air of the night, when the metal might be expected to be less tough than ordinarily. The outer ring being weakened by having the vent hole through it, with the possibility of the weld happening to be at the same spot. The radial venting was condemned and the breech prepared for an axial vent, experiment being first made to see whether the "friction tubes" would strike through the distance necessary, which it was found they would do easily. The vent hole in the gun tube was tightly plugged, and the new rings, when ready, shrunk on. No alteration was made in the breech block beyond boring the vent hole through the obturator bolt, and providing a safety device to prevent the friction tube blowing out behind and possibly injuring some person. These alterations, as shown in Fig. 4, being completed, the gun was taken out to the redoubt again and put in action, but at the first shot under the new conditions the obturator bolt (the same one as had been used all the time, and with which about 100 rounds had been fired) broke as shown in Fig. 4. A spare breech block had already been prepared, with the obturator bolt increased in size to 2 inches diameter without shouldering, and the end brought right through the back plate, but at the first shot this one also broke off short under the mushroom head, and it was beginning to be an anxious time to know what to do to make something which would stand the shock, when one of the fitters let out that he had known a time at Woolwich when six or seven similar bolts had broken with successive shots—which statement somewhat relieved the anxiety—and he further suggested annealing in oil as an expedient which might help. This was immediately done, several bolts being made for emergencies, and none broke after that. The present breech block is shown by Fig. 5, which also shows the peculiar drawing-down action taking place in these bolts. Three of them were used with two breech blocks from that time until the 15th of February, when Kimberley was relieved, about fifty rounds being fired by each bolt. The only way to account for the action seems to the writer to be that the shock of the explosion drives the whole bolt back, compressing the asbestos pad. Then, on the relief from the pressure, the pad expands again, tending to bring the bolt back to its original position, which is opposed by the inertia of the body of the bolt, causing a tensile stress in the bolt which is sufficient to cause permanent set at the point where the greatest stress comes—close to the head. A photograph of one of the bolts is shown in Fig. 13.

Kimberley was relieved before any further difficulties arose, and the gun is now resting, waiting for its next position which it is expected will be in a prominent position in the town, forming part of a monument to the memory of those who fell in the defence of Kimberley, and chiefly of him who originated it—George Labram—who, by his great mechanical skill and general resourcefulness in all matters contributed in no small degree to that end, and who was most regrettably killed only a few days before relief came.

A Micrometer Gear Tooth Gage.

The cut clearly shows all that is essential of a recently devised gage, and also the application of it. As will be seen, its sole function is the measuring of the thickness of spur gear teeth at the pitch line, for the purpose of ascertaining their accuracy and discovering any errors in the cutting. The jaw at the right is fixed to the bar of the instrument, while the other jaw is moved in either direction by the micrometer screw, the nut of which is fixed to the other end of the bar. By this means the thickness of the tooth may evidently be measured as accurately as in any other applications of the micrometer, provided the points of the measuring jaws are brought to the proper location on each side of the tooth. The positions of the jaws relatively to the tooth are determined by the central vertical micrometer screw. The point of this screw is always central relatively to the jaws, and the micrometer adjustment of it brings



A MICROMETER GAGE FOR GEAR TEETH.

the jaws to the correct hight for the pitch line according to the pitch of the gear whose tooth is to be measured. To keep the vertical screw always central between the jaws, it evidently must move in the same direction as the movable jaw, but at half the speed. The small horizontal screw which moves the block which carries the central or depth micrometer is a continuation of the screw which moves the thickness measuring jaw, but the pitch of the screw is only one-half that of the larger screw, and the pitch also is reversed. Thus, if the principal screw is forty to the inch and right-handed, the small screw for moving the depth gage must be eighty to the inch and left-handed. This instrument will, of course, do its work as accurately as any other micrometer employing this familiar means of minutely indicating the movements of measuring jaws, provided it is accurately made, which, of course, it must be. This gage has recently been patented by Joseph H. Boulet, 34 Pleasant street, Beverly, Mass.

Letters from Practical Men

Indexing Reference Books.

Editor American Machinist:

The value of any book of reference depends not only upon the scope and accuracy of the information contained therein, but also upon the ease with which any particular fact may be found and utilized. Generally speaking, the greater the scope of any single volume, the greater is the length of time required to find the desired information. Of course, this statement could not properly be made in respect to small books that are meagerly indexed as compared with large volumes in which the index is very full and thoroughly subdivided. In any book of considerable size it is necessary to first consult the regular index at the front or back of the book, and later the reading matter or tables containing the fact sought. For instance, without long familiarity with such pocket-books as "Kent," "Nystrom," or "Trautwine," it is most convenient to refer to the index, and so find the numbers of the pages likely to be of service in your investigation; whereas in a small pocket-book containing, say, the properties of structural shapes of some one of the large steel concerns, it is more convenient, after using the book for a short time, to turn directly to the page.

Thus it becomes evident that if the pocket-books which are used by all engineers were "thumb-indexed," after the manner of modern dictionaries and Bibles, their value would be very greatly increased by reason of the greater ease and rapidity of consultation. The so-called "thumb-index" practically divides the single large volume into a greater or less number of small ones. It is certain that no one can realize its full value until it has been tried in connection with his most used books.

The process of "thumb-indexing" is exceedingly simple when one is provided with a sharp pen-knife. Several years ago I began by putting several such index marks in my "Nystrom," and found them to be such great savers of time that I not only added to their number in the original book, but extended it to other books which I used most often. Some of these books have perhaps one or two such marks, while I notice that at present my "Kent" has thirty-four subdivisions.

A short time ago an engineer, on seeing some of my reference books, remarked that it would be a fine thing if the publishers of such books would index them in this manner, the same as is done with Bibles. In this I can only partially agree with him. For instance, if the publisher of "Haswell" were to index that book so as to greatly help all who use it, the great number of titles would be extremely confusing, and there would be no room for further additions to the list. The work of every engineer, draftsman and mechanic varies from that of every other to such an extent that a scheme of indexing that would exactly suit one would leave out a great many things most frequently wanted by another. For this reason I believe that it is best that each man should index his own books with reference to those things to which he refers most frequently. The following of this plan will result in great savings of time at those times when time is the most important of all quantities.

FRED B. COREY.

Points on Molding a Shrouded Pinion.

Editor American Machinist:

For the benefit of all interested, and especially those molders who seldom come in contact with a gear pattern, I will offer a few words on the correct method of molding a shrouded pinion. It is of course done in a three-parted flask, and calls for no special remark until after the cheek is rammed up. Then before the parting is made a fine vent wire should be run down between each two adjacent teeth, afterwards filling up each hole near the surface. Next, each tooth should be nailed, pushing in the nails at an angle from the face of the pattern. Now make the parting, and ram up cope, putting a gate pin on the top, near the center of the pattern, so that, when pouring, the iron will not strike the teeth of the mold. An equally good method of running is with a horn gate, on the bottom shroud. After the cope is lifted, cut a channel for vent, with the point of the trowel, in a circle about 3 inches back from pattern; then cut other channels from this circle to the outside of the flask. Next take a vent wire and, entering the sand at the circle spoken of, run the wire down at an angle, between each pair of teeth of the pattern, so that the point of the wire will strike the pattern, about one-third of the depth of the

cheek. These will intersect the vertical vent holes made before the cope was rammed up. Now, perhaps, comes the most important part of the whole proceeding. At this point is where an otherwise perfect mold is often spoiled, the molder making the fatal mistake of taking either a swab or a sponge and wetting around the edges of teeth too freely, not stopping to realize that the iron passes over this swabbed part. The result is that when the metal comes in contact with this "mud," I was about to call it, a boiling takes place, caused by the excess of steam generated, and the tops of these sand teeth are "chewed" off by the molten iron. These detached parts, lodging in the upper flange, invariably spoil the casting. Instead of this swabbing, a light spraying with either the mouth or a can made for the purpose, is the proper thing. H. W. BURY.

Making a True Spindle.

Editor American Machinist:

Many of the readers of the "American Machinist" may never have had occasion to make a spindle for a milling machine or lathe, and while many may know the exact procedure by which a spindle is made that is practically accurate, this article may be interesting to a great many who do not. I will seek to illustrate the method followed by a certain firm building a high class of grinding machinery, milling machines, etc. The spindle is first roughed out and the taper hole bored and reamed to the exact depth by means of a stop-collar which drives on the reamer to the proper distance. A piece of steel *a*, Fig. 1, is then gripped tightly in the chuck and turned to fit the taper of the hole in the spindle for about 5-16 inch, and the spindle wrung on it tight enough to turn a bearing on the nose *b* for the steady-rest, and a very light cut taken off the end *b*, allowing the end *c* to run free off center. The spindle is then turned around in the lathe and *c* gripped in the chuck, the nose *b*, Fig. 2, running in the steady-rest (not shown). A test-bar *d*, 24 inches long, the end of which fits the taper of the spindle perfectly to the full depth of the taper, the remainder of which is straight and just as round as it is possible to make it in a Brown & Sharpe universal grinder, is then driven very lightly into the spindle, care being exercised that both bar and hole are free from dust, as a very slight speck makes a great difference in the length of a 24-inch bar.

The jaws of the chuck are then moved, until with a Brown & Sharpe indicator the test-bar runs without any perceptible error at the mouth of the spindle and within a limit of .00025 at the end of the bar. A light cut is then taken off *c*, Fig. 2, as close as possible to the chuck to form a bearing for the steady-rest. The spindle is then taken from the lathe, the test-bar removed, a taper plug, hardened and ground, is substituted in its place, and it is again put in the lathe with the center of plug on live center and the bearing *c*, Fig. 2, in steady-rest. The end *c* is then re-centered, and it is ready to be finished.

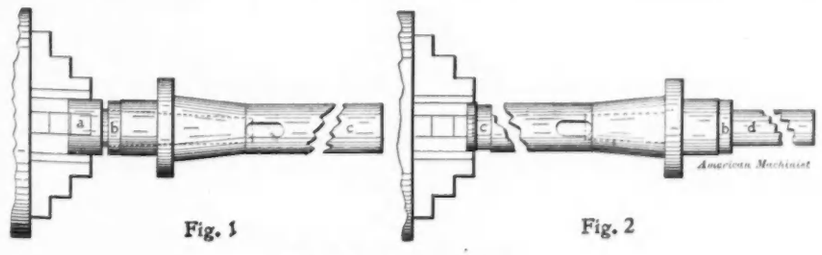


Fig. 1 Fig. 2

MAKING A TRUE SPINDLE.

It may not be necessary for all classes of work to have a spindle as accurate as the above, but this method will produce a spindle in which a center can be changed to any position without a wink of the indicator needle, provided, of course, that the center is ground true.

W. E. CALLAGHAN.

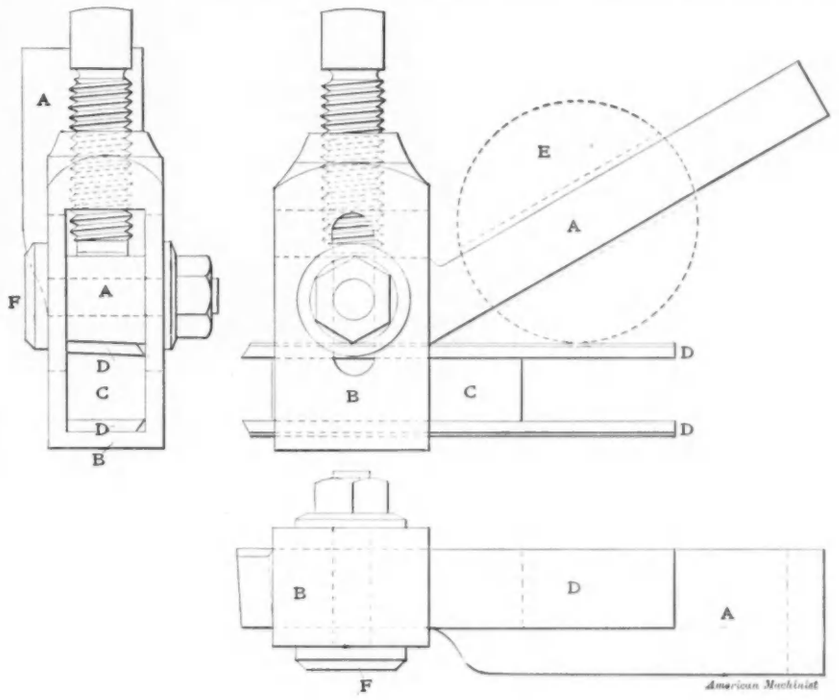
Erie, Pa.

Adjustable Tool for Piston Rings and Piston Grooves.

Editor American Machinist:

I send a sketch of an adjustable tool, one of two that I had made, for sizing the packing rings and the slots in the pistons to receive them, for a number of sizes of engines with rings varying from 5-16 to ¾ inch in width. The tool shown is for the rings; that for the piston grooves is just the same, except that the angle in the end of the strap *B* and on the side of the shank *A* is just the reverse of the angles as here shown. The shank *A* is held in the tool post just as the lathe tool is held. The top and bottom sides of the projecting portion of the shank are parallel and the sides of the strap *B* just fit them. The bolt fits a round hole in the shank, while the hole in the strap is elongated. The side of the shank *A*, against which one of the tools *D* is held, is inclined a little to give side clearance to the tool, and the inside of the end of the strap *B* is inclined in the opposite direction to give similar clearance to the other tool. There are several blocks *C* provided, of different thicknesses for the different widths of rings required. The screw binds the tools and the block together, and the tightening of the bolt then fastens all securely.

The casting for a set of rings is bolted to the faceplate, roughed out on the inside, and then finished on the outside in the usual manner. Then with an ordinary cutting-off tool, a little wider than cutter *D*, cuts are made into the casting to the depth of the thickness of a ring, and just far enough apart to leave the width of a ring and enough for finishing both sides of the same between the slots. Then by



LATHE TOOL FOR PISTON RINGS.

placing in the lathe the tool here shown, each ring is sized by one feeding in of the cutters, after which the rings are separated by boring to size on the inside, allowing them to drop off.

For the slots in the piston a roughing cutter 1-16 inch less than the width of the slot is first used; then after all the slots in a piston are roughed out the roughing cutter is replaced by the finishing cutter, by simply loosening the set screw and binding bolt, without changing the adjustment of the tool in the lathe, and both sides of the slot are finished at once. For roughing out slots that are so wide that the casting will not stand a good feed, cutters of half the width of the slots are used, making two cuts, then finishing with a cutter of the full width. The tools work nicely, and the rings and slots are kept to size without any trouble and with much less expense than by the former method, where the sizing was done with the ordinary side tool. CHAS. C. ABBOTT.

St. Johnsbury, Vt.

Rig for Making Little Screws on a Speed Lathe.

Editor American Machinist:

Some time ago we had an order for a lot of brass thumb screws like *X*, Fig. 1. Diameter of head 9-16 inch, threaded end, about ⅛ inch long, No. 6 machine screw size. We had no screw machine, so we made an attachment for our lathe.

The lathe has an extra long cross slide, with place for tool post on each end. We took a piece of 1¾-inch square machine steel *B*, Figs. 1 and 2, and screwed a smaller block B^1 on top, and on these were mounted the circular forming tool, cut-off tool and knurl for milling the head. Through a hole in the block is a short spindle or shaft, carrying on one end the formed cutter and on the other end the lever for operating the attachment. Lever and cutter are both fast on the shaft. A casting with a hole with hardened bushing was bolted to the lathe carriage close up to the cross slide, to support the stock close to the cutter. On the opposite side of the slide is another casting with pins, against which the lever strikes to move the slide across.

At the beginning of the stroke the cutter approaches the stock at the proper cutting angle, and as the lever is carried over it moves the cross slide upon which the block is fastened, and at the same time revolves the cutter so as to keep the cutting edge always at the proper angle to the work until, at the top of the stroke, the cutting edge is vertical and the cutter passes entirely over the now formed screw. The slide is advanced farther, until the cut-off tool *H* cuts off the finished screw. The knurl *B* passes under the screw at the same time that the forming tool passes over it, so that any burr made in milling the head is cleaned off by the forming tool.

A wire pick-up was made to keep the screws from falling down with the chips. We used a fast speed, about 1,200 per minute, and kept a good stream of water on the work, and turned out screws at the rate of 450 per hour.

Referring to the sketches, *F* is the circular forming tool, a block *D* with the knurl for milling the heads, and block *E* holds the cut-off tool *H*. *D* has a screw underneath for adjusting the hight of the knurl.

Block *E* has a hole for a screw slotted to allow for adjustment sideways, and is split, so that the tightening of the screw will tighten up on the cut-off tool. The cut-off tool, being set at an angle, can be adjusted in hight by setting in or out. *G*

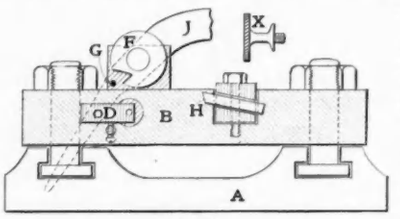


Fig. 1

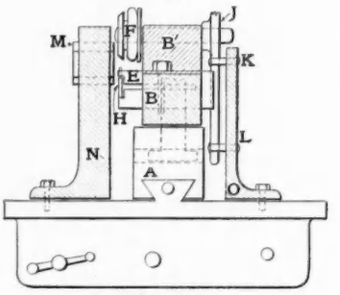


Fig. 2

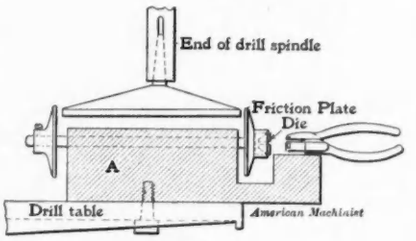


Fig. 3

MAKING SMALL SCREWS ON A SPEED LATHE.

is a stop for the end of the stock to strike against and regulate the length of the screws. This point also indicates about the center of the screw. Lever *J* extends back so as to be in reach of the operator.

M is a hardened steel bushing held in the casting or bracket which is bolted to the top of the carriage. Pins *K* and *L* in casting *O* are for lever *J* to strike to move the slide forward. Another pin (not shown) strikes the front of the lever in bringing the slide back again. Lever *J* is rigidly connected with cutter *F*, so that both turn as the slide moves forward.

Now, suppose a bar of stock, 9-16-inch brass rod, sticks through bushing *M*, the other end held in the chuck, with the lever back, the cutter as in Fig. 1 and the end of the brass rod against stop *G*. By lifting up on lever *J* the slide is moved forward with a slow movement by coming in contact with pin *K*, thus bringing the cutting edge of *F* in contact with the revolving brass rod, and as the lever is pushed upward and forward the whole slide, with cutter, etc., is pushed past the rod, and at the same time the cutter is slowly revolved so as to keep the cutting edge in the right position in relation to the work, and by the time the screw is completely formed the cutter can pass entirely over the rod, and the lever now coming in contact with pin *L*, brings the slide forward at a faster speed until the cut-off tool finishes the work and a wire pick-up catches the screw to keep it from falling down with the chips. The milling tool having done its part while the forming tool was at work, any burr turned up by the milling tool would be cleaned off by the forming tool.

Fig. 3 shows the rig used for threading the screws. *A* is a casting with a shaft *B* carrying a threading die and two friction wheels. The shaft turns freely and has about ½-inch end play. A pair of Bernard plyers *C*, with a place milled in the jaws to fit the screw head, was fitted to slide in front of the threading die. The plyers being held open by a light spring, the operator had only to place a screw blank in position in the jaws with his left hand, and with the right close the plyers and push forward until the screw touched the die, thus also moving the shaft and friction wheel, which would cause the die to revolve and cut the thread. By pulling back on the plyers when the thread has been cut, the shaft is moved endwise in the opposite direction so as to bring the other friction wheel into operation and thus reverse the die and back the screw out. With this rig we threaded the screws at the rate of 700 to 800 per hour. We tried self-opening dies first, but found that the screws were so short, and so few turns were required to cut the full length of the thread (only about four turns), that when the dies opened they left a burr at four places on the screw where the cutting edges of the dies were. Using solid dies and backing the screws out avoided the burr. Some nuts to go with the screws were tapped in the same way, by substituting a tap for the threading die.

J. E. P.

No Smoke Gage Required.

Editor American Machinist:

Someone is suggesting to me that besides the noise gage that is so much needed, and the dirt gage that it would be so handy to have, but neither of which we have the least promise of ever obtaining, there is a third which is perhaps as desirable and even as necessary as either, and that is a smoke gage. I do not accept the suggestion. Noise and dirt seem to be to some extent unavoidable, as industrial operations are now conducted, but they

are nevertheless decidedly objectionable, and therefore it would be well to gage them, as an important help in keeping them at a minimum. We might find how little noise and dirt it would be possible to get along with, and then, having a ready means of determining and demonstrating the amount, we would be in a position to insist upon it.

The status of smoke is distinctly different from that of noise and dirt. It is of course not less objectionable than either, or perhaps both of them, but while we concede to them some necessary right to a limited and temporary existence, no such concession should be granted to smoke. It is practically entirely avoidable. If anyone is disposed for a moment to question this he does not live in New York city. And if he lives elsewhere, he can no longer question it after visiting the city and looking out from a window of a tall office building, or any other point of vantage, in any direction, over the industrial, the commercial or the residental portion of the city, and noting its glorious smokelessness. Few cities of the world have any feature of which they can properly be more proud and boastful. Few cities offer the world an object lesson more important and beneficent for all to learn. Let the denizen of any smoke-defiled city be privileged to look for a single minute through the clear atmosphere that normally hangs over the island of Manhattan, and if he does not regard it with envy, and if he does not highly resolve to strive for the attainment of the same condition for his own place of residence, he deserves to be continually choked and blinded by the modern abomination.

The only smoke gage that is needed, or that should be insisted upon, is the gage that New York city has. It is not to gage how much or how little smoke there may be, but whether there is any smoke or not. If there is any visible smoke there is too much.

New York is not without it object lessons on the detestability of smoke. In some of the craft which are still permitted to move and have their being on its surrounding waters it has smoke enough and to spare. The dense moving column of dirty blackness and the spreading pall of gloom from ferryboat or tug or coasting steamer are still in evidence.

The modern torpedo boats, whether Uncle Sam's or not, are doing the world at least one good service, and I have never heard of their doing any other. They show us, in a way that leaves much less to be desired, how not to burn coal. The sight of a torpedo boat surging along anywhere, almost completely wrapped in and concealed by its voluminous black mantle, is an experience never to be forgotten, and a thing for no government ever to be anything but ashamed of. As the torpedo boat is to rush unawares upon the enemy, the smoke must be intended for a disguise. Certainly if it could for any reason be desirable for one of them to make more smoke, it would be a matter difficult of accomplishment. Recent remarks in the columns of the "American Machinist" have shown how the smoke of the torpedo boat is caused by the premature chilling of the furnace gases by the too close proximity of the cold-water tubes, and many writers tell us and many experimenters have shown us that soft coal may be burned without smoke.

It is not a question of hard coal or soft coal, and the exclusive use of the former, that determines the smokelessness of a city, although the smoke complained of may be that emanating from soft coal. The soft-coal excuse or apology is not a satisfactory or even a tenable one; and indeed the smoke question is not one to be even mitigated by apologies or excuses. It is ourselves with whom we are dealing, and we do not usually apologize to ourselves or try to frame excuses to ourselves for enduring detestable things. We only think of getting away from them. We thank our friends for showing us the way of escape, and never for assuring us that we must drag our chains for life.

Soft coal is really a city's opportunity for absolute smokelessness. If the smoke so long endured shall, after all, lead us to the adoption of smokeless fuels or to the burning of soft coal without smoke, then it may one day become a thing to be cherished with the kindliest of memories. The good time coming may be long on the way, but it is distinctly in sight. Coke is more smokeless than anthracite, and gas, also smokeless, is the ideal fuel for almost every purpose. We may insist that only in these forms shall coal enter our cities unchallenged, and when it comes in its original solid blackness it shall be upon its good behavior. As we are assured that smoke is not an inseparable accompaniment of it, let the complete separation of it be insisted upon.

TECUMSEH SWIFT.

Legal Notes.

BY WM. MARSTON SEABURY.

SPECIFICATIONS WAIVING IMPLIED WARRANTY OF FITNESS FOR PURPOSE—NO CONTRIBUTION BETWEEN JOINT WRONG-DOERS.

Gregg & Son's suit for damages against the Page Belting Company was recently decided by the Supreme Court of New Hampshire in Hillsboro county. Before this suit was begun Joseph Levesque had sustained injuries through the falling of Gregg & Son's elevator, and had recovered a judgment against Gregg & Son for his injuries.

The plaintiffs in this action contended that the fall of the elevator and Levesque's consequent injury was caused by the negligence of the belting company in repairing the belt by which the elevator was sustained and operated. They brought the action to recover the amount of the judgment obtained by Levesque against them, which they paid. The belt was made by the belting company about two years before the accident, upon the plaintiffs' order for a belt of a specified size to run an elevator, and expressing a preference for a cemented belt; *i. e.*, one with cemented instead of riveted laps. The plaintiffs introduced evidence tending to show that at the time of the accident one of the laps that was cemented by the belting company in making the repairs came apart, in consequence of which the elevator fell, and that the lap was improperly and negligently cemented. The trial court ordered a verdict for the defendant, and on appeal the judgment of the lower court was not disturbed, the appellate court holding that there was no express warranty that the belt was fit for the purpose for which it was used, and none could be implied, since the plaintiffs directed the size and method of constructing the belt, and relied upon their own judgment, and not upon the judgment of the manufacturer. The court further held that the fact that Levesque could have recovered damages against the belting company would not entitle the plaintiff to recover against the belting company for the reason that if the plaintiff were permitted to recover against the belting company the universally accepted law that there can be no contribution between joint wrong-doers would be disregarded. (46 Atl. Rep., 26.)

NEGLIGENCE AND CONTRIBUTORY NEGLIGENCE QUESTIONS FOR THE JURY.

The Hanford Produce Company was the owner of a large building in Sioux City, in which was operated an elevator called a "platform" elevator. This elevator was enclosed on two sides. Between two of the floors of the building an iron girder extended into the elevator shaft in close proximity to the elevator platform when it was on a level with the girder. One Olson was employed by the Hanford Produce Company to run this elevator. Olson was not warned of the presence of the girder, nor the danger of coming in contact with it. The elevator shaft was dark, so that it could not readily be seen, and Olson was ignorant both of the existence of the girder and of any danger. On one occasion Olson was taking a load of merchandise from one floor to another, and stood so that his foot extended over the edge of the elevator. As the elevator passed the girder his foot came in contact with it and he was seriously injured. Olson brought suit against his employer to recover damages for his injuries thus received.

The defendant demurred to the plaintiff's petition upon the ground that it showed no negligence on the part of the defendant, that the plaintiff assumed this risk, and that he was guilty of contributory negligence. The trial judge dismissed the plaintiff's case, and he appealed to the Supreme Court of Iowa.

The appellate court, in reversing the

judgment of the trial court, held that the question of the defendant's negligence in leaving the sill or girder projecting so near the elevator without a guard, as well as the question as to whether the plaintiff was guilty of contributory negligence in allowing his foot to extend over the platform of the elevator, was for the jury, and not for the trial court to decide.

The court further held that as it was the duty of the defendant to furnish the plaintiff with a safe place in which to work, and also to inform him of any danger incident to the work not clearly apparent, the plaintiff had the right to presume that his employer would do his duty in these respects, and that if the plaintiff proved the allegations he had made a jury would have been justified in finding that he had not assumed this risk. (82 N. W. R., 903.)

DAMAGES FOR INJURY TO FINGERS.

Paul Stiller, Jr., was employed by the Bohn Manufacturing Company, and for about a month operated a rip saw, occasionally running the planing and jointing machines. He was then set to work under another foreman upon a crosscut saw machine sawing blocks of wood. It happened that on the third day after he commenced work on this machine he was sawing in the usual manner, when the slide of the machine suddenly jumped from its bearings on the rails and knocked his left hand into the saw, whereby his index finger was cut off and his thumb and second finger injured. It further appeared that when any material downward pressure was applied to the left or unsupported end of the slide, the right or further end would be lifted from its rails so that the slide would swing around when the saw struck the board held by the operator, exposing him to the danger of his hand being caught in the saw, and in this manner Stiller was injured. He brought suit to recover damages and received a verdict from the jury of $4,500. This the trial court considered excessive and would have granted a new trial upon this ground had not the plaintiff consented to reduce it to $3,500. From the judgment for this amount the defendant appealed to the Supreme Court of Minnesota. There were various grounds of appeal, and among others that the verdict of the jury, even as reduced by the trial judge, was excessive.

The appellate court upon the other grounds of appeal held that the evidence was sufficient to warrant the finding of a verdict for the plaintiff, and that the jury were justified in finding that the plaintiff had not assumed the risk incident to the use of the machine and that he had not been guilty of contributory negligence.

It was of the opinion, however, that $3,500 was an excessive sum to allow the plaintiff to recover for the injuries mentioned. It therefore directed that unless the plaintiff accepted a judgment for $2,500 a new trial should be had. (82 N. W. R., 981.)

Echoes From the Oil Country—VI.

"Say, can you fix this reel? I want it just like this other one. Put your best man on it, and tell him to take his time and do it right. I don't care two cents what it costs, but if it isn't right there will be a great big row. The last one I got fixed only cost me $2.40, and I nearly got done for with it, and I don't want you to fix this one for less than $5. What do I do? Well, anyone would know you were new to the oil country to ask that with that wagon standing there."

The speaker was a quiet, good-looking man, with a clear blue eye, who had driven up in a rather queer-looking wagon and thrown two reels filled with about ⅜-inch lines in on the floor. I looked with much interest at the vehicle and outfit, which was a well shooter's, and found an excellent set of springs mounted on first-class wheels. The seat was roomy and turned up on hinges and disclosed a space divided up so that a can of nitro-glycerine just filled each division, which was carefully padded, both bottom and sides, and the bottom covered with rubber that came up several inches, so as to catch anything that might come from a leaky can, which is no rare thing.

"It might make good axle grease, but I never wanted to carry the experiment very far, although I had a can once that I was carrying in an ordinary buggy leak down on the axles. You see, there isn't much curl to my hair yet," said the shooter, as he was showing me the rig.

Each can holds eight quarts, which weigh twenty-six pounds. Some wagons are made for sixteen cans, although this one only held twelve. A couple of brackets bolted to the left-hand side of the body carried the pieces which formed the rack for the shells and anchors that make the torpedoes. The arms of the rack are carefully covered with rope or cloth, and come up high enough to bring their load into easy reach of the driver. Behind the seat was room for the reels, etc.

"Mr. Smith said you wanted to see a well shot, and if you get that reel all right, and a couple of go-devils ready by the time I get back I will take you on, and as I intend to use the reel you fix, you had better either fix it right or make your will," said the shooter, with a laugh, as he drove off.

Just after dinner he came back, loaded in one reel, put in the go-devils, took me and started. The "go-devils" are castings about 15 inches long, with wings extending out 2 inches each way from a center. They are let fall into the hole and strike the top of the shell, setting off the fulminate of mercury cap that explodes the glycerine. The wings act as guides to keep them straight in the hole. They must be of the most brittle, rotten iron possible, so that they will go into small pieces after doing their work.

Soon we left the main road and went twisting and turning among the trees and rocks, and presently drew up before a small board building about 12 feet square and 8 feet high, that had a sign on both front and rear:

NITRO-GLYCERINE
KEEP AWAY

It was without windows, and the door had heavy hinges, and a heavy bar across it was secured by a strong, good padlock; for, strange as it may seem, my companion informed me it was no uncommon thing to have a magazine broken into and a wagonload of the contents stolen. On one side of the door hung a horse shoe held by a string. Inside were arranged several wagonloads of cans; not shooters' wagons, but stock wagons, that hold from seventy-two to ninety-six cans. Twelve cans were quickly placed under the seat, and we started again. Somehow the road seemed rougher and the horses not nearly so steady after we were loaded, although I was assured that the wagon always swung easier when loaded. As if this road was too good, we turned off into a mere track, where the trees had simply been cut down to enable a team and wagon to get through. I would much rather have walked, but my companion seemed very unconcerned, and I reflected that if that was his ordinary occupation I would try to stand it for once. He kept regaling me with anecdotes of his experiences with those who wished to ride and didn't know his business; how some would make him stop while they got out and ran, while others would get out, but stay long enough to bless him for not telling before they got in.

As the road kept getting steeper and stonier I did not hear all the stories he told me, but began to wonder if I couldn't manage to get jolted out. I am afraid he guessed my thoughts, as he began telling about the rattlesnakes and copperheads he had killed going through this country, and he showed me a string of nine rattles he had in his vest pocket. I hate snakes, and decided to hold on, but couldn't help feeling that the fools weren't all dead yet, and fearing that one of them might be any minute, and without leaving much behind him for his friends to mourn over. At length we reached the main road, and in a few minutes a well up on the hillside was pointed out as our destination. Some more rough road brought us to within about 50 feet of the derrick floor, when the horses were unhitched, taken off some distance and each one securely tied to a tree.

Now the real business of shooting the well began. After learning the depth of the well and how far above the bottom the sand was, enough of the small tin pipe known as anchors was brought up and jointed together to hold the shell in the required place. The reel was bolted to the engine flywheel, as near the center as convenient. The drilling engine is a center-crank, with flywheel on one side and

pulley on the other, and the shaft does not extend beyond either hub. The tools had been stood on the casing head to help hold the casing in when the shot went off, and to them a small rope carrying a pulley was lashed in such a position as to be directly over the hole.

At this point the drillers and owner concluded that they had business elsewhere, and had faith enough in the shooter to let him finish without them. Six trips, with a can in each hand, brought the nitro-glycerine up over the rocks and logs to the derrick. I didn't offer to help, and he didn't invite me. The line was run from the reel through the pulley, the anchor fitted to the bottom of the shell, the shell carefully lowered into the hole and hung on the hook at the end of the line. This hook is made so that when the torpedo rests at the bottom of the well it unhooks, and the bail drops to one side.

Before leaving, the drillers had poured water into the hole so that it stood about 300 feet deep, the hole being 1,174 feet deep altogether. On the top of the shell, just under the bail, was a round piece of iron with a ¼-inch rod, on the lower end of this rod a long cap which rested on a small anvil piece. The go-devil, when dropped, should strike the plate and explode the cap.

The shooter went out to the reel and drew the shell up so that the top stood about 3 feet above the floor, and securely locked the reel. The cans were then uncorked, and I noticed that there were two corks to each can, the holes being on opposite corners, as they didn't want any slopping over. The contents were poured into the shells, and looked much like fine, winter strained lard oil. It was hard for me to realize the energy stored up there, and that a few drops was enough to tear me into shreds.

As we walked back to the reel my companion remarked that perhaps I had better withdraw to a distance as the most dangerous time was at hand.

"When I start letting off that brake, if anything should stick and then drop, it might be interesting, and if the reel don't work smooth and even I can't tell how things are going down in the hole. Sometimes a shell sticks and unhooks, and sometimes the bail lets go. If your reel has hard spots you never feel sure." As he spoke I began to realize that a few cents on the price paid for getting things just right didn't count for anything in a business like that. In a few minutes the shell was at the bottom, and I was given the privilege of dropping the go-devil. We walked off about 150 feet and waited. I must have been a hoodoo, as the shot failed to respond, and another go-devil did no better. Then a jack squib was made. This is simply a small tube with about two or three ounces of nitro-glycerine in the bottom, several feet of waterproof fuse, with a cap on the lower end in the glycerine, coiled up, and some sand packed in to make weight to sink it through the fluid. The fuse is lighted and the squib dropped into the hole. This did its work. We could feel a jar; then came a rush of air, then sand and gravel, and with a great rush and roar the water and dirt came forth, going high over the top of the derrick.

In a gusher country this might be followed by a flow of oil amounting sometimes to several thousand barrels in twenty-four hours, or by a flow of gas, with a pressure of hundreds of pounds per square inch and a roar that can be heard for miles. All the fire under the boiler and elsewhere around a well is extinguished before shooting, as some gas is always present, and many men have been burned up by the gas igniting. This well turned out to be a small pumper. We left it to the drillers to finish; they had it to clean out, and then the owner tubed it.

As I drove back with the shooter it seemed a long time since I had left the shop, and I didn't think I would care to exchange jobs with him if he did get $5 per shot for his work, and it made me feel crawly to think of a man getting up in the night and taking on such a load, as is often done. Most of the hauling of stock is done at night, as it is cooler, there are less teams on the road and fewer people to kick about hauling it through the towns.

W. Osborne.

New Freight Classification—Prospective Litigation.

The Merchants' Association of New York has consulted its counsel concerning the rights of shippers who are members of the Merchants' Association under the new classification of the Southern Classification Committee, effective over all the roads in the South operating south of the Ohio River and east of the Mississippi River, including the steamship lines from ports within that territory to New York.

Mr. Baldwin advises the Merchants' Association that it has a sufficient cause of action on the ground of the reasonableness of the rates, and has advised that action be brought in the name of the Merchants' Association against some one road in Southern territory, on some specific item affected by the new classification, and that the action be brought without delay before the Interstate Commerce Commission at Washington. In accordance with this advice, papers in the proposed proceedings are being prepared and will be filed at the earliest possible date.

The Southern Classification Committee promulgated a classification which went into effect June 1 of this year, which was an advance in rates through a comparatively new system of classification, having a direct effect upon some 1,700 articles, set forth in the schedule of this classification committee. At the time this new classification was promulgated the Merchants' Association of New York protested against it, claiming that it was a departure in the principles of classification which would work great harm to shippers in New York and elsewhere in the North, not only by raising the rates unduly, but by widening the difference between carload and less than carload rates, and would act as a prohibitive to shipments in many instances, thereby lessening the area of distribution.

American Skill and Machinery in a German Shoe Factory.

United States Consul C. W. Erdman, Breslau, Germany, sends us an interesting account of the recent equipment of a German shoe factory:

"R. Dorndorf's shoe factory, of Breslau, has engaged an American and his wife to take charge of and reform the works. The factory, the largest in Germany, employs 450 hands, and is entirely equipped with American machinery." Here follows a list of fifty-three machines, which it is not necessary to reproduce, and the report goes on to say: "All brushes, bottom-finishing material, ink, stains, paints, etc., are of American manufacture. The American is engaged for one year at a salary of $90 per month; his wife receives $36 per month, and traveling expenses to and from the United States are paid. The wages paid in the factory to the different hands vary from $4.28 to $5.95 per week.

"Before the American took charge the factory produced 142 pairs of shoes per day. After the lapse of only eleven days it turned out 462 pairs, or over three times as many as under the German manager, with the same machinery and the same number of hands. They expect to produce by September 1 over 500 pairs of shoes per day. As the men turn out more work they receive more wages, these having been increased already 2 marks (48 cents) per week each; and when they produce over 500 pairs of shoes per day the wages will again be increased 48 cents per week. The German mechanics in the factory are pleased with this way of doing business.

"Another American is employed here by the phonograph factory of H. Meinecke. Another, a technical engineer, is engaged by the iron works at Laurahuette, and an American firm is putting up electric apparatus by American mechanics in Kattowitz. American machinery of all description is being introduced into this district, and if our manufacturers would send traveling men speaking German to this industrial center, or establish agencies here, they could build up a good trade."

Horse-power of Machinery at Paris Expositions.

Under date of July 14, 1900, Consul-General Guenther, of Frankfort, says: The modern demand for high-power machinery is shown by a comparison of the machinery exhibited at the last four

world's expositions at Paris. In 1867 there were exhibited and operated 52 machines, with an aggregate of 854 horse-power; in 1878, 41 machines, aggregating 2,533 horse-power; in 1889, 32 machines, with 5,320 horse-power; and in 1900, 37 machines, with 36,085 horse-power. The average horse-power per machine exhibited in 1867 was 16; in 1878, 62; in 1889, 170; and in 1900, 973—a most startling increase. France this year exhibits and operates 18 machines, with an aggregate of 14,435 and an average of 802 horse-power. Other countries operate 19 machines, with 21,650, or an average of 1,140, horse-power.

Versatility.

Although we are fond of calling this the age of the specialist and of saying that specialism is necessary to success, one of our esteemed contemporaries seems determined to do all it can to prove the contrary. Its contents always cover a wide range, but a recent issue is particularly a gem in that respect. It leads off with an article on "Hydraulic Engineering in the Metropolitan Power House," then tells us what it knows about some machine tools of various kinds, and after discoursing upon weighty financial questions it winds up with an elaborate illustrated description of a patent duplex, compound, telescopic lather brush called "Royal," and which it seriously informs us combines the advantages of both a short and a long bristle brush, and that it will "cause the lather to penetrate and soften both skin and beard."

Education in the Y. M. C. A.

We have received copies of the Annual Report and of the Prospectus of the Educational Department of the Young Men's Christian Association. The Report gives in detail the record of the year's work, including that of the 134 evening schools taking the recent international examinations, the list of 1,498 successful students and the names of the 108 colleges and universities which are encouraging this work to the degree that they give official recognition to international certificates. The Prospectus contains the brief outline of the movement, its objects, the list of examiners, the syllabi or outlined courses of study in the twenty-six fundamental subjects now provided, also the regulations governing the examinations, and the complete sets of questions used last year.

The first named pamphlet can be obtained at a cost of 20 cents, and the second at 25 cents, by addressing the secretary, Geo. B. Hodge, 3 West Twenty-ninth street, New York.

A Swindler.

Editor American Machinist:

We ask for sufficient space in your columns to warn others against a young smooth-faced chap, slight-built, with poor and irregularly shaped teeth, claiming to be a son of a Mr. Palmer, of Palmer Shipbuilding and Iron Company, at Jarrow-on-the-Tyne, England. He came to us July 26, 1900, in all the freshness of his youth, and evidenced, by his apparent personal knowledge, an acquaintance with nearly all the large shipbuilding companies of this country, as well as those abroad. He claimed to have visited and been well received by the Union Iron Works, The Cramps, Bath Iron Works, etc. He showed a familiarity with English methods, railway conveniences, time tables, etc., and displayed no little knowledge of lines pertaining to the shipbuilding trades, as well as our own. He claimed knowledge of our London representatives and a close friendship with the family. We found ourselves his creditor for a small amount and received the assurance of a remittance on the following day. This was a month ago, and we, having heard nothing from him, and being advised by our London people that there is no such party, and that we are practically sold, desire to thus warn others against such a person, and if possible protect from an imposter. He was blessed—either by nature or acquired—with as fine an English accent as could be desired; was an entertaining fellow, and we really do not feel that he owes us very much after all, but we don't quite like his methods of obtaining relief while on his travels.

NORTON EMERY WHEEL COMPANY.

Personal.

J. H. Hill has resigned his position as superintendent of shops of the University of Minnesota, and will be instructor in mechanical practice in the agricultural and mechanical college at Bozeman, Mont.

Obituary.

J. Allen Mosher, master mechanic of the E. Howard Clock Company, died at Onset, Mass., August 15, forty-seven years old. He had been in the employ of the company twenty-three years.

A serious objection to the Parsons or other turbine for marine propulsion has been in its non-reversibility. This may be in process of elimination. We notice that a United States patent has just issued to Charles A. Parsons for a reversing turbine, "to enable the blades to work efficiently in both directions."

It is reported that $100,000 stock has been subscribed to the Grant Machine Tool Company by citizens of Franklin, Pa., and that the business will be moved from Cleveland to that place.

The Draper Company, Hopedale, Mass., shipped 1,654 looms during July, which is nearly 200 more than in any previous month.

The Bethlehem Steel Company, of Bethlehem, Pa., announces that it has discontinued its St. Louis office, and the territory hitherto covered by that office will be henceforth handled from the Chicago office direct.

The committee whose duty it is to make the nominations for the various offices to be filled at the annual election of the American Society of Mechanical Engineers has sent out a circular to all the members inviting the suggestion of the names of suitable candidates. This seems to be a very sensible and commendable thing to do. The nominees of the committee are usually elected unanimously, and, although no fault can be found with the results of the arrangement, it would seem more proper if more of the members could have some active participation in the selection, and this invitation affords the opportunity, which it is to be hoped will be generally availed of.

A big haul of scrap iron is being made in the upper lake region. The Iron Range & Huron Bay Railroad, 62 miles long, was built seven or eight years ago, and no regular train has ever run over it. A gang of fifty men has started to pull it up by the roots. It would be rather interesting to know just how they do the job. We can imagine that they go to the farther end of the line and pull the rails up behind them as they go.

The letter of the person who inquired for an authority on brass foundry matters has been mislaid (got into our file prematurely). Will the person please send his name and address to the editor?

Miscellaneous Wants.

Advertisements will be inserted under this head at 25 cents a line, each insertion. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded.

Gear Wheels, gear cutting. Grant; see p. 20.

Dies & punches, Amer. Hdw. Co., Ottawa, Ill.

Caliper cat. free. E. G. Smith, Columbia, Pa.

Forming lathes. Mer.Mach.T.Co.,Meriden,Ct.

Punches & dies. Wal.M.Wks.,Waltham,Mass.

For Sale—2½ H. P. gas engine, nearly new, $65. J. H. S., Box 1171, Springfield, Mass.

Light and fine mach'y to order; models and elec. work specialty. E. O. Chase, Newark, N. J.

Book "Dies and Diemaking," $1, post paid. J.L.Lucas,Bridgeport,Ct. Send for index sheet.

F. J. Stokes Machine Co., 13th and Noble sts., Philadelphia, Pa., build light machinery.

"Brandt's Triple Expansion Gaskets" are the best for boilers. Randolph Brandt, 38 Cortlandt st., New York.

Wanted—Names of manufacturers of coating machines for blueprinting paper. Box 250, AMERICAN MACHINIST.

First-class parties want to hire a modern machine shop; gas belt preferred. Address Box 243, AMERICAN MACHINIST.

Will trade for a good farm or sell machine shop with a good business in N. E. Iowa. Address Box 258, AMERICAN MACHINIST.

Threads and gears; easy rules to cut any thread possible to be cut in the lathe, without algebra, sent to any address for 25c. by G. W. Dixon, Spring Lake, Mich.

Water-front property and well-equipped iron or steel shipbuilding plant and machine